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NAVAL OUTGOING MESSAGE PROCESSING,

A study of message generation and message preparation for transmission and the impact of automation

> Naval Ocean Systems Center (Code 8125) Marine Corps & Special Systems Branch

> > Final Report — December 1979



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AN ACTIVITY OF THE NAVAL MATERIAL COMMAND

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Commander

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This study was prepared under Naval Ocean Systems Center (NOSC) Project FN09 by members of NOSC Code 8125. Code 8125 is a branch of the Ship and Shore Communications Systems Division (Code 812) of the Communications Systems and Technology Department (Code 08) at NOSC. The study effort was conducted under the general guidance of the Navy Science Assistance Program Coordinator (NSAP) (NOSC Code 18) in response to NSAP Project SURP-1-78 tasking. This study effort took place during March through August 1978. Participating in the composition of this report were R.H. Bowser, W.D. Carpenter, G.C. Dorsey and R.P. Milne, all of NOSC Code 8125.

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EXECUTIVE SUMMARY

BACKGROUND

This report is the result of a Commander, Naval Surface Force, U.S. Pacific Fleet (COMNAVSURFPAC) request to the Navy Science Assistance Program (NSAP) to study the means and methods available to remedy the message preparation and entry problem of afloat ships. The request was made also to list and to price available component terminal equipments. NSAP tasked NOSC to do this study based on previous work at NOSC in message preparation, entry and distribution. The study proposes a modular concept that can stand alone or be integrated with any of the appropriate NAVMAC systems. This study was not required to develop the ultimate answer to the message entry and processing problem, but to present a near term solution to existing problems. This study provides guidelines for SURPAC to evaluate various means of message entry and message processing with their associate costs.

OBJECTIVE AND APPROACH

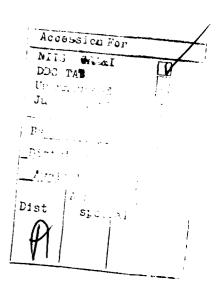
- Analyze the impact of the media selection on message generation and preparation
- Analyze the impact of automation on the Naval outgoing message process
- Develop conceptual message generation and preparation systems at various levels of automation and with various choices of media
- Develop an equipment data base and project system costs

For this study the outgoing message process was segmented into message generation and message preparation (Figure 1) functions. Message generation functions (Figure 2) were delineated as:

- Rough draft
- Draft
- Edit
- Coordinate
- Chop
- Approve
- Release

Message preparation functions (Figure 3) were delineated as:

- Accept
- Prepare
- Transmit
- Backroute
- File
- Ancillary



EVALUATIONS

Message processing media were defined as the vehicle used to contain a message during transport from one message process function to another. The presently used medium is type on paper and the media chosen for evaluation were:

- Visual (type or print on paper)
- Magnetic (card, disk, cassette, etc.)
- Electric (hard wired)

The choice of media is more important to message generation than to message preparation. By definition, a fully automated message processing system would use electrical medium. This report concludes, however, a fully automated system for outgoing message processing is not as cost effective as a stand-alone system.

Thus, it was necessary to recommend media other than electrical as the choice for all but the fully automated ship. Media evaluation is summarized in Tables 1, 2 and 3. The visual media showed greater merit than magnetic and the visual media were recommended. In recommending the visual media, it is necessary to spend some time discussing the visual media reader — the optical character reader (OCR).

The OCR is available, reliable and suitable to the task of a message input device. The authors have first hand experience with tactical message preparation systems using OCR equipment for entry and have found some to be acceptable, suitable and desirable input devices. OCRs vary in their ability to read typed documents. This varying ability has to do with character contrast, line skew, character misalignment, etc. It is this qualitative characteristic of optical character reading which generates the emotionalism concerning OCRs. Attachment A to this report details the experiences regarding automated message entry system using an OCR as input device and gives numerous examples of the material (skewed, misaligned, etc.) which the OCR found acceptable.

The message generation functions did not lend themselves well to full automation and partial automation was best served by the visual media. The chop, coordinate, approval and release functions involve people and people involved need or want a hard, readable message copy to read, mark up or file. Therefore, these functions are not cost effective candidates for automation except in fully automated ships. The message composition functions (draft and edit) do lend themselves to automation assistance; this assistance is categorized as basic and advanced. The basic aids would permit changes to a message without message retype (i.e., by use of symbols and correction pages) and consist of character erase, overwrite, insert: line insert, delete and paragraph insert, delete. Recognition of symbols and action capabilities would reside in the message preparation system and would be cost effective and desirable aids to implement.

Advanced automation aids run the gamut from word search and replace or delete to input data validation and interactive prompting. These aids imply machine storage of the message with the machine providing a clean copy of the message after edit. The machines range from commercial grade "smart" typewriters (\$5000) and word processing systems (\$15,000) to full MIL-SPEC message composition stations and cannot be recommended for wholesale replacement of the typewriter as the prime message composition tool. It is recommended, though, that a few commercial grade smart typewriters be provided at high volume, high precedence message composition areas within the ship.

A subset of the message composition function is pro forma message composition and this area is ripe for automation. Pro forma message composition would be cost effective if automated at a single, central location as part of an automated message preparation system. The format of a pro forma message is rigidly specified. Thus, users need only to indicate the type of message desired and the data to be inserted. This would be a cost effective candidate for automation if provided in areas such as supply (MILSTRIPS) and either as a standalone hard copy system or electronically interfaced with an automated communication system.

Many functions in message preparation can be benefited by automation. For the most part message acceptance involves people and is not a cost effective candidate for automation. The message preparation for transmission, however, can be enhanced greatly by automation. The following tasks within this function are considered candidates for automation:

- Assign and log unique DTG
- Validate message parameters
- Determine format of delivery circuit
- Validate PLAs
- Prepare message in correct format and LMF
- Place message in proper outgoing queue

Automating these tasks will improve accuracy, save time and personnel hours and reduce personnel requirements. Automating the message transmission function requires an interconnect of an automated message preparation system to an automated communications system and the development of software to control the interface properly. The cost effective candidates for automation within the message backrouting function are:

- Determine recipients
- Duplicate, collate and slot message copies

Automation of the delivery task is cost effective only on a fully automated platform. The file maintenance function is a prime area for automation. The customer request function is a prime area for automation assistance with access to the data base being the primary task to be automated. The tedious and time consuming task of recording message statistics and making reports can be greatly benefited by automation. The file destruction function is highly dependent on the file media used and is not an area that can be enhanced effectively by full automation.

Four levels of increasing capabilities, cost and complexity for an automated message preparation system (AMPS) were formulated as a result of this study. Each succeeding level of AMPS contains the automated functions of the preceding levels, as well as additional new functions. AMPS can be incorporated into any computerized communication systems such as NAVMACS, MPAS and COMPARS.

AMPS I is defined as the basic outgoing message preparation system. It automates those functions within a communications center which require the greatest number of personnel and are characterized as being the most time consuming and prone to human error. In particular, it automates the preparation of an ACP 126 modified message for

transmission. Other outgoing message processing functions are accomplished manually, semi-automatically or by systems such as the naval modular automated communications system (NAVMACS) or the message reproduction and distribution system (MRDIS).

The development of AMPS I is a low cost, low risk proposition. It automates the processing of 80 to 90 percent of the typical outgoing message traffic on a small ship and provides significant enhancement to message processing on large ships.

AMPS II is the most cost effective level of the four levels of capabilities being considered. In addition to the capabilities of AMPS I, AMPS II automates the validation of plain language addresses (PLA) and address indicator groups (AIG), message filing and retrieval functions and formatting of JANAP 128, ACP 126 messages. It is a moderate cost, low risk proposition. It automates 90 percent of the typical outgoing message traffic and is suitable for medium to large ships.

AMPS III capabilities are essentially the same as the outgoing message processing capabilities of NAVMACS V4 with MRDIS. In addition to the capabilities of an AMPS I and AMPS II, the AMPS III increases the variety of input devices, generates data pattern messages, automates some of the backrouting functions and, additionally, automates those functions typically called for in only five to 10 percent of outgoing message traffic (sectioning, segmenting, retransmitting, readdressing, etc).

The development of AMPS III is a high cost, low-to-moderate risk proposition and provides only a small increase in capability over AMPS II at a considerable increase in cost. This system is suitable for large ships.

AMPS IV, in addition to the capabilities of AMPS I, AMPS II and AMPS III, uses remotely located, networked KDTs for the message composition, staffing, releasing and delivery functions. It also uses remote LPs for electronic delivery of messages being backrouted.

While AMPS IV would automate all message preparation functions, its development is a very high cost, moderate risk proposition that is practical only on fully automated ships.

CONCLUSIONS

To provide a near term, cost effective system with minimum changes to the present method of message preparation, chop and release the paper reading, (OCR) AMPS II is determined to be the modular system that can be used as a stand-alone system or be incorporated into any computerized communication system such as NAVMACS.

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GLOSSARY

ACP Allied Communications Publications

ADP Automated Data Processing
AIG Address Indicator Groups

AMAP Automated Message Assistance Processor

AMES Automated Message Entry System

AMPS Automated Message Preparation System
ASCII American Standard Code for Information

Interchange

COMMANAVSURFPAC Commander of Naval Surface Force

U.S. Pacific Fleet

CMTU Cartridge Magnetic Tape unit

CNO Chief Naval Operations
CPU Central Processing Unit
CSN Channel Sequence Numbers

DAAS DoD Automatic Addressing System

DTG Date Time Group

EMMCT Electrical Media Message Composition

Terminal

EMMVT Electrical Media Message Verification

Terminal

FIFO First-in-first-out HF High Frequency

ITA#2 International Telegraph Alphabet #2

JANAP Joint Army Navy Air Force Publication

KDIT Keyboard/Display Intelligent Terminal

KDT Keyboard/Display Terminal LMF Language Media Format

LP Line Printer

MCS Message Composition Station

MDU Magnetic Disk Unit
MED Message Entry Device

MMMCT Magnetic Media Message Composition

Terminal

MMMVT Magnetic Media Message Verification

Terminal

MMR Magnetic Media Reader
MPA Message Preparation Aid

MPDS Message Processing Distribution System

MRDIS Message Reproduction and Distribution System

MTU Magnetic Tape Unit

NAVCOMPARS Naval Communication Processing and Routing System
NAVMACS Naval Modular Automated Communications System

NELC Naval Electronic Laboratory Center

NOSC Naval Ocean Systems Center

NSAP Navy Science Assistance Program

NTDS Naval Tactical Data System
OCR Optical Character Reader
OPEVAL Operational Evaluation

PCR Punch Card Reader
PLA Plain Language Address

PTP Paper Tape Punch
PTR Paper Tape Reader
RI Routing Indicator
SSN Station Serial Number

SURFPAC Naval Surface Force U.S. Pacific Fleet

TD Technical Document

TEMPEST An unclassified short name referring to investigations

and studies of compromising emanations

TOF Time of File
TTY Teletype

USAREUR United States Army Europe
USMC United States Marine Corps

VMMCT Visual Media Message Composition Terminal

BACKGROUND

This report has been prepared by NOSC Code 8125 for NSAP (Project SURP-1-78). The NSAP tasking was an outgrowth of an earlier NSAP effort (Project TH-2-75). In the earlier NSAP project a feasibility model of an automated ongoing message preparation system was installed onboard the USS OKLAH DMA CITY in April and May 1976. It used an optical character reader as an input device. The results of feasibility model testing are contained in Reference 1 and indicate a high degree of acceptance by users and a significant increase in communication center efficiency on the OKLAHOMA CITY. A subsequent request by the OKLAHOMA CITY requesting continued usage of the test system* resulted in SURFPAC direction** to study further the effectiveness and efficiency of automated outgoing message preparation systems and candidate message entry devices as applied to the shipboard message preparation process.

NOSC Code 8125 has developed significant background in the advancement of automated outgoing message preparation systems and in the use of keyboard/display terminals (KDT) and optical character readers (OCR) as message entry devices. It also has expertise in microprocessor systems, smart and dumb terminals and magnetic card, tape and disk input devices. Related efforts by Code 8125 in the field of message preparation and entry are as follows:

- OCR Selection Criteria and Equipment Survey (Reference 2)
- Feasibility Model Development of an Automated Message Entry System (Reference 3)
- USS OKLAHOMA CITY Automated Message Preparation Study and Feasibility Demonstration (Reference 1)
- Feasibility Demonstration of a Tactical Message Preparation System for USAREUR (Reference 4)
- Advanced Development of an Automated Message Entry System (AMES) for USMC (References 5 through 15)

STUDY DEFINITION

The object of this study is to analyze the outgoing message process of Navy ships and to determine which message generation and preparation functions are cost effective candidates for automation. A second object is to analyze the various media by which a message might be routed through the message generation process and to recommend the desired media and suitable message entry device(s).

As shown in Figure 1, this effort has been broken into the message entry device study and the automated message preparation system study. These are artificial and arbitrary divisions but they suit the study goals and simplify and bind the analyses. For this study, the processing of outgoing naval messages has been broken into message generation and message preparation for transmission. Message generation is the process from creation

^{*}USS OKLAHOMA CITY has retained and continues usage of the feasibility test system; this system is presently installed on the USS BLUE RIDGE

^{**}COMMANAVSURFPAC 222110Z DEC 77

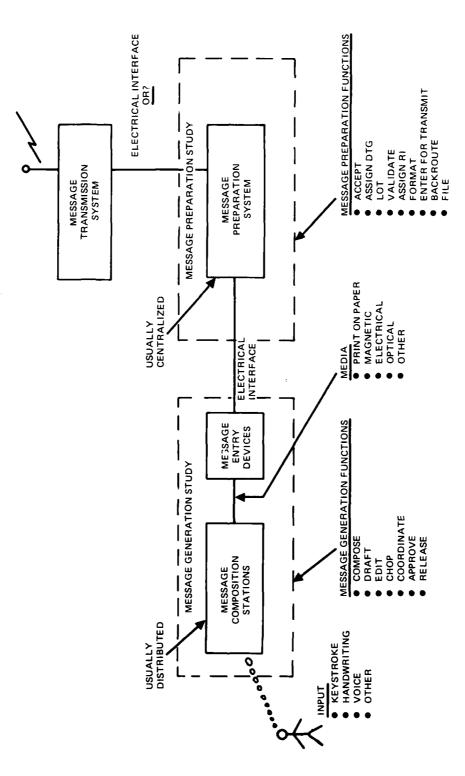


Figure 1. Outgoing naval message processing -- study definitions.

of rough drafts through command approval and release. Message preparation is concerned with actions normally taken in the communications center to ready a message for entry into the message transmission system.

As shown in the figure, possible inputs to the message composition station are voice, handwriting and keystroke (typewriter or keyboard). Voice and/or handwriting are desirable but presently not state-of-art and thus the keystroke emerges as the input of concern.

MESSAGE ENTRY DEVICE (MED) STUDY

The message entry device study concerns itself with the message composition stations to be distributed throughout a ship and the message generation process from message composition to delivery at the communications center window (or equivalent) for preparation and transmission. Message generation functions have been flowcharted as depicted in Figure 2.

A driving force in this study will be an analysis of the media used for message routing. At present this medium is paper (DD-173 forms or equivalent) and the message composition station, a typewriter. A trend toward automation would imply an upgrading to smart typewriters or even a replacement of the conventional typewriter with a keyboard/display terminal and a resultant trend toward electrical routing of messages.

Smart terminals offer up a host of message composition aids, none of which are present in the current system and many of which offer significant benefit. The media could remain type on paper or could be replaced by electrical, magnetic, paper tape or other machine readable code. It should be noted that any departure from a human readable medium results in a substantial requirement for distributed reader/displays and attendant hard copy devices. It is now, and will remain in the future, human nature for all in the process to want a personal hard copy. It should be noted further that most media dictate a continuance of the messenger/mail routing of messages for chop and release, whereas one, electrical, evokes images of a hands off, speed-of-light message transfer.

In all cases, there is a need for an <u>automated</u> input into the message preparation system (communications center). The present manual poking of formatted paper tapes, with its attendant errors and bottleneck at the input to communications center processing, is not tolerable. All media in question satisfy the requirement of being machine readable; however, type on paper has the advantage of being human and machine (by optical character reader) readable, thus retaining a familiar and comfortable system (minimum perturbation and user confidence). The electrical media eliminate the messenger/mail routing but at a high cost in electronics and ADP equipment (complexity).

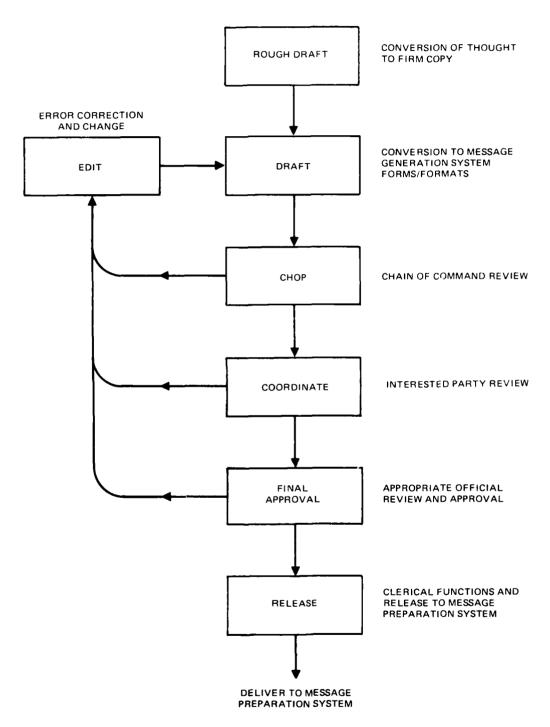


Figure 2. Message generation flow.

AUTOMATED MESSAGE PREPARATION (AMP) STUDY

The AMP study will concern itself with functions performed primarily by the shipboard communications center. These functions will be called message preparation functions and are depicted in Figure 3. Shipboard communications center functions are prime candidates for automation and several systems exist which address this area. Many data on time and error reduction are available. The time savings in hours in communication center processing is a typical result of communications center automation.* This number is reduced somewhat in significance when balanced by the overall writer-to-reader time of typical (routine and priority) Naval message processing (but during high tempo most of the formal routing and approval is skipped and the delay in the communications center then becomes very significant). Automation also reduces the number of required communications center personnel as well as message errors. It should be noted there is a growing trend toward incorporating some automated message preparation functions into the message transmission system.

^{*}Quite often time is saved from improved message composition and entry in conjunction with automation of communications center functions.

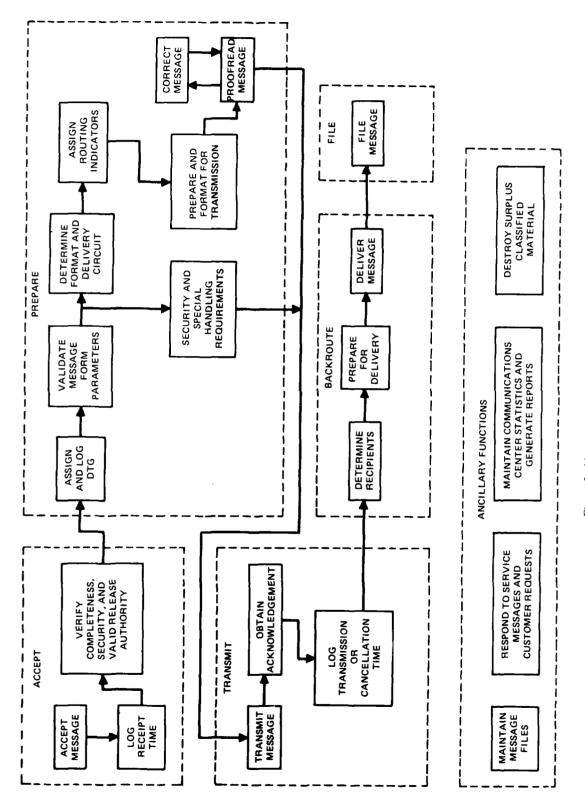


Figure 3. Message preparation functions.

MESSAGE GENERATION

Within the Navy, Chief of Naval Operations (CNO) has recently promulgated (OP-643C/LEX2D5 Ser 771307 of 16 February 1978) a set of rules for message text formatting. These rules concern themselves with the textual portion of Navy data pattern messages. The communications header portions of messages continue to be specified in Joint Army, Navy, Air Force Publication (JANAP) 128 (G) Allied Communications Publication (ACP) 127 (E).

An objective of this message text formatting, as stated in the rules from CNO, is to produce messages which are both understandable by humans and compatible with ADP. Their goal should be the goal of all future shipboard message generation and preparation systems.

MESSAGE GENERATION FUNCTIONS

For the purposes of this study the shipboard message generation functions are as depicted in Figure 3 and defined as follows.

- Rough draft: Writing down thoughts and/or data in rough form
- Draft: Preparation of a message on a medium suitable for edit, chop, coordination, approval and release
- Edit: Changing or correction of message content by deleting, adding or substituting words, phrases, sentences or paragraphs; restructuring the message content also would be an edit function
- Chop: Changes in a message by the chain of command to insure readability and conformance to proper format and content; review and approval by the chain of command
- Coordinate: Disclosure of the message to interested parties in the immediate area who need the information for planning purposes or who will be affected by the action of information contained in the message; anyone reviewing the message may suggest changes
- Final Approval: Formal authorization for message transmission by the command
- Release: Transfer of a message from the release authority to the communications center after approval; approval of a message for transmission is noted by a unique identification (i.e., signature) of a release authority

FUNCTIONS ANALYSIS

The following paragraphs concern themselves with the significant divisions of the shipboard message generation process and discuss the effect, implications and constraints of automation on this process.

Message Composition

There are several automated message generation functions which are aimed at helping the writer compose his message. These aids break into the major categories of proforma message and narrative message composition aids.

Pro Forma Message Composition Aids

Pro forma messages include RAINFORM, weather, communications status and fuel status reports, DAAS supply messages and others whose format is rigidly specified. The structure of pro forma messages is rigidly specified so that data may be accepted by computers for automated processing. Therefore, it is necessary that the message be absolutely correct in format as well as data content. Also, the header lines are usually fixed. Thus, a message composition aid which automatically generates significant portions of pro forma messages would save time and improve accuracy. Such a device is the message preparation aid (MPA) developed and evaluated by Naval Electronics Laboratory Center (NELC) in 1973. The MPA and an evaluation is the subject of NELC TD 305 of 14 February 1974. Note that pro forma message generation could be accomplished at a centralized location. The individuals responsible for generating the message need only specify the type of pro forma message and the data to be inserted.

Narrative Message Composition

Working from the assumption that the smart typewriter or a keyboard/display terminal (KDT) will replace the typewriter/message form as the tool of message composition, then there is a use and a need for narrative message composition aids. Narrative message composition aids run the range from delete and correct to spelling and syntax validation. It should be noted that it is not necessary to discuss the output (electrical, hardcopy, magnetic tape, etc.) of the KDT or its interface to the balance of the message generation process to cover the merits of the message composition aids. Distributed KDTs would imply significant capital expenditure and maintenance support costs. The smarts involved have to be provided either centrally (electrical/support requirements) or locally (increasing the cost of KDT). The implied evolution is toward an electrical interface and electrical routing through the message generation and preparation process. This would require significant changes to internal routing and approval procedures and substantial store and forward capabilities and alerts. Again, this requires significant capabilities which have to be provided for either locally or centrally.

Message Chop and Coordination

The chop and coordination functions will be performed by personnel who must be able to read the message. If the medium containing the message cannot be read, then a special reading device must be provided, e.g., a magnetic tape reader and display if the medium is magnetic tape. The chop and coordination can be done with printed copies of the message given to the appropriate people for review. After the chop and coordination processes, suggested changes can be written on copies of the message and given to the message writer who then will edit the original message. Thus, we see the "other than paper" media reverting to paper during chop and coordination and edit.

Message Approval and Release

Before the message is received by persons designated as the release authority, all chop, coordination and editing should be performed on the message. If the medium containing the message cannot be read, then a special reading device must be provided. The release authority must show approval on the medium bearing the message before releasing it to the communication center and must be completely confident that the medium contains the message in the exact form that was approved originally.

MEDIA

Media Evaluation

Message generation is done for the significant types of media. Media selection criteria are the subject of Appendix F. The type of media for message entry considered are typewritten pages, binary electrical signals and binary magnetic fields on disks, tapes and cards. The generalized model shown in Figure 4 is used to illustrate the message flow for discussion of the media.

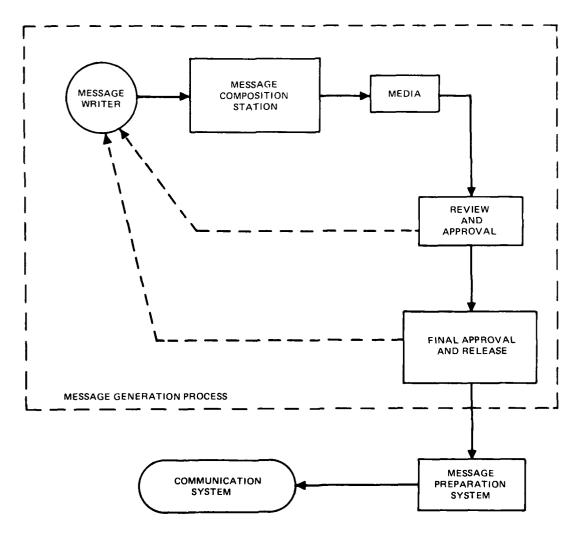


Figure 4. Message generation system model – general.

Typewritten Page (DD-173 Form)

This medium permits the appropriate people to read the message without using special equipment and facilitates coordination with those individuals concerned with the purpose and effects of the message. Since the message is printed on paper, it can be reproduced. Suggestions and changes can be noted on a paper copy of the message and returned to the message writer. The message can be carried to any place where the review personnel are located. The routing procedures and safeguards for classified message handling can be the same as for other paper documents. A message generation system using DD-173 forms as the medium is depicted in Figure 5. A message printed on a DD-173 form is readable by humans and compatible with message entry equipment when an optical character reader is the message entry equipment.

Typewriter for Message Generation

The following steps explain the flow of messages typed on DD-173 forms through the message generation process:

- STEP 1. A draft message is typed and copies are given to appropriate personnel for chop and coordination.
- STEP 2. The review personnel will make changes on a copy of the message and return it to the message writer or indicate that the message needs no change.
- STEP 3. The message writer will make any changes on a copy of the message and give it to the typist for correction. If the typewriter has a storage device and editing functions, the typist can recall the message from storage and edit it. If a conventional typewriter is used, editing of a message is accomplished by indicating where the change is to be made and typing the desired change on a correction page. These correction pages are also readable by the OCR. Note that it is not necessary to retype the entire message.
- STEP 4. Copies of the revised message are given again to the review personnel.
- STEP 5. Steps 2, 3 and 4 are repeated until no changes are made and the message is ready for final approval.
- STEP 6. The message is delivered to the release authority for review and signature. If the message is not released, it is returned to the message writer with appropriate explanations. The message composition process would continue at Step 3.
- STEP 7. After the message is approved and signed by the release authority, it is delivered to the communication center.

Keyboard/Display Intelligent Terminal with Printer for Message Generation

There are advantages in using a keyboard/display intelligent terminal (KDIT) with a printer instead of a typewriter. They are the potentials for an extensive editing capability, memory for storing several types of pro forma messages and prompting/validation or restriction of characters entered in the message. The time required for editing a message or generating a pro forma message probably would be shorter using a KDIT instead of a typewriter. The steps explaining the generation and flow of messages using a KDIT with a printer are the same as those stated in the preceding section except the typewriter is replaced

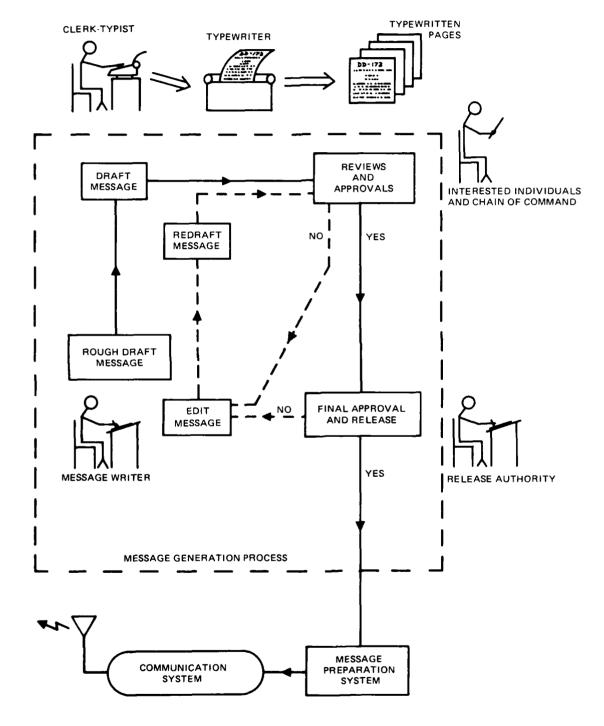


Figure 5. Message generation system model – typed DD-173 form as medium.

with a KDIT and printer. Such a system is depicted in Figure 6. The KDIT with a printer would cost considerably more than a typewr₁ r.

Electrical Signals

This medium is compatible with message processing equipment but is not readable by humans. This medium enables a fast transfer of a message between equipments after keyboard entry. The equipment for converting the message to electrical signals is a KDIT. The features of a KDIT are the same as those stated as advantages in the preceding section. A printer would be used with the KDIT to print a copy of the message for review and editing by the people concerned with the message content. Appropriate security safeguards should be implemented to ensure that the KDIT and any personnel viewing the KDIT are cleared for a classified message. To review the message, the release authority would use the display on any available KDIT. After the release authority read and approved the message, an identification unique to each release authority would be entered after the message to show approval. After approval and release, no changes in the message content would be allowed. The following steps explain the generation and flow of messages using the electrical medium. These are shown pictorially in Figure 7.

- STEP 1. The message composition station (MCS) operator will key the message into the KDIT and route electrically for reviews and approvals. Hard copies would be printed out for review by appropriate persons.
- STEP 2. The appropriate review personnel will make changes on a copy of the message and return it to the message writer or indicate that the message needs no change. The review and approvals could be done either on the KDIT and routed electrically or on a locally printed copy and routed by messenger.
- STEP 3. The message writer will make appropriate changes on a copy of the message and give it to the MCS operator for editing.
- STEP 4. A new copy of the edited message is electrically routed for review again by the appropriate personnel.
- STEP 5. Steps 2, 3 and 4 are repeated again until no changes are made and the message is ready for final approval.
- STEP 6. The release authority is notified that a message is ready for approval and transmission. The release authority reviews the message on a KDIT display and enters a unique code word at the terminal to show approval. If the message is not released, the message writer should be notified via the electrical medium and the message returned to the writer with whatever explanation is appropriate. The message composition process would continue at Step 3.
- STEP 7. The release authority would transfer the released message using the electrical lines to the communication center from the KDIT.

Binary Magnetic Field (Magnetic Disks, Tapes or Cards)

This medium would use a keyboard for message entry and a magnetic writing device for recording. The equipment would be a KDIT with the capability as stated in the preceding section for message generation and a magnetic write/read unit for recording

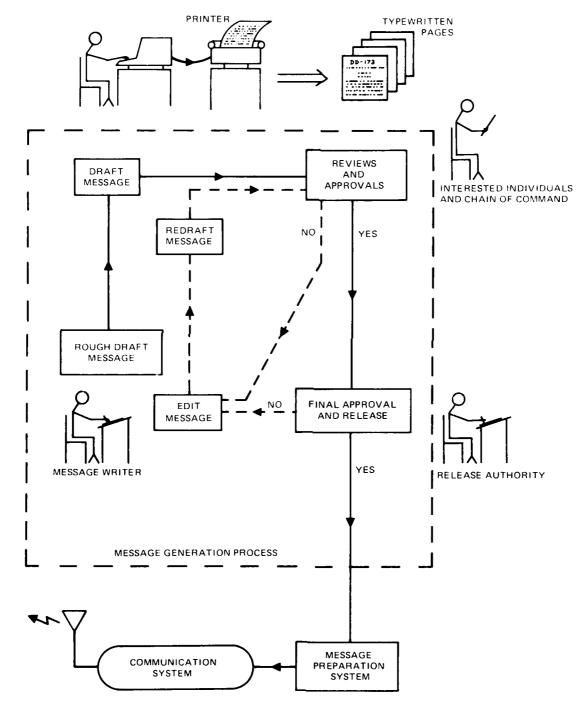


Figure 6. Message generation system model -- printed DD-173 form as medium.

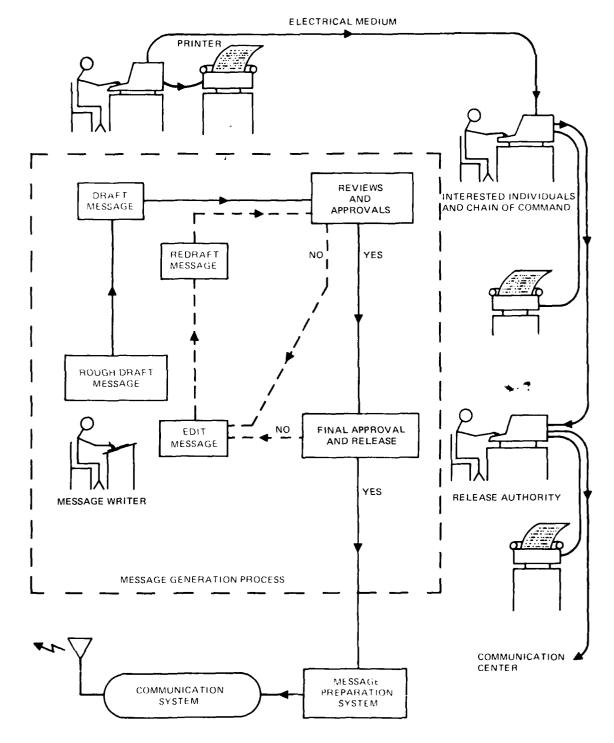


Figure 7. Message generation system model electrical medium.

on the disk, tape or card. The magnetic write/read unit could be peripheral to the KDIT or integrated into the KDIT. A printer would be a necessary peripheral unit to the KDIT. Read terminals would be needed at the review and approval stations as well as available to the release authority to examine the message because the magnetic media are not readable to humans. The following steps explain the generation and flow of messages using the magnetic medium. The flow is depicted in Figure 8.

- STEP 1. The message composition station (MCS) operator will key the message into the KDIT and have it written on the magnetic medium for review by appropriate individuals. The message may be stored only on the magnetic medium. Hard copies will be printed for review and approval personnel who do not have readers.
- STEP 2. The appropriate review personnel will make changes on a copy of the message and return it to the message writer or indicate that the message needs no change. The changes may be made on a hard copy printed locally or a modified message written on the medium provided for review.
- STEP 3. The message writer will make appropriate changes on a copy of the message and give it to the MCS operator for regeneration on the magnetic medium.
- STEP 4. New copies of the edited message are rerouted again for review by the appropriate personnel. The edited message replaces the original message on the magnetic medium. Hard copies are provided where necessary.
- STEP 5. Steps 2, 3 and 4 are repeated until no changes are made and the message is ready for final approval.
- STEP 6. The message as recorded on the magnetic medium is delivered to the release authority for review and approval. The release authority may use a special magnetic reader or the KDIT magnetic write/read unit for displaying the message. If the message is not released, it should be returned to the message writer with whatever explanation is appropriate. The message composition process may continue at Step 3. The release authority adds a unique code word after the message and signs on the magnetic medium container to show approval.
- STEP 7. After the message is approved and released, it is delivered to the communication center.

Multimedia

A multimedia system could use two media; for example, the typewritten page and binary electrical signals. The typewritten page would be DD-173 forms printed from typewriters or printer units peripheral to a keyboard/display intelligent terminal (KDIT). The message media would be as described in the preceding sections. The message composition systems would operate in parallel up to the point of message entry into the communication center.

To have a minimum delay in composing and entering a message for processing, the electrical medium would be used with the KDIT in the MCS connected directly to the message processor. The KDIT in the MCS would serve as a remote message entry terminal of the processor.

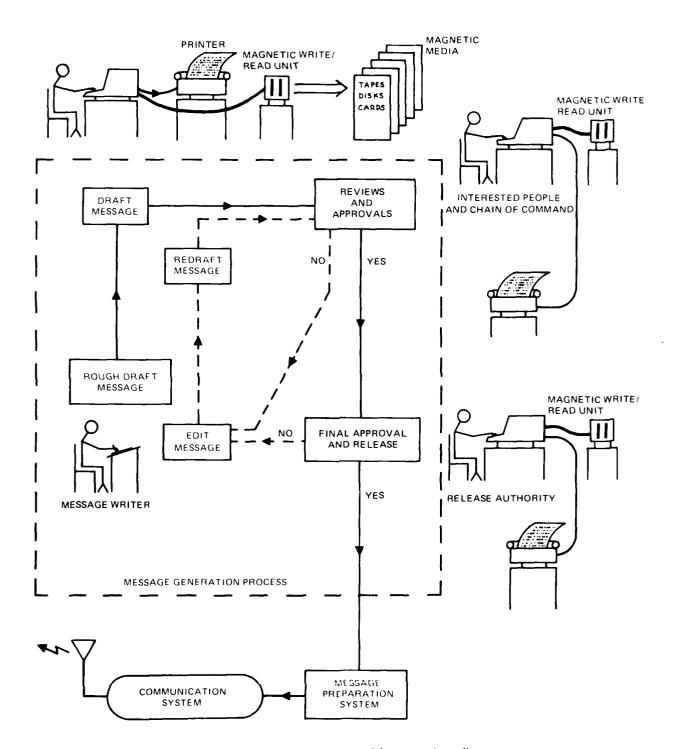


Figure 8. Message generation system model - magnetic media.

Media Evaluation Results

The media are evaluated with respect to readability by humans and machines, equipment costs for the message generation process and the number and training of personnel as discussed in Appendix F. Cost estimates of the typewritten page and magnetic media are shown in Table 4. Media costs become an important consideration if the proper security precaution is to destroy the medium after using it only once.

Table 1. Visual media (typed or printed page) evaluation summary.

No user impact as this is the present medium

Handled like other paper documents in reference to precedence, security and routing procedures

No special equipment, training or skills required for personnel performing message chop, coordination, approval and release functions

High user confidence

What is read and signed is what is transmitted

Know precedence and security with certainty

Media cost is low (\$0.01 per page)

Commercial grade OCR typewriters are adequate

Provide the basic automation aids for message composition

No new equipment required outside of communications center if OCR typewriters already in use

Comparatively low costs for equipment, training, maintenance and support

Message chop, coordination and approval functions are best accomplished on page media where changes can be penciled in and the original message draft can still be read for comparison

Data integrity/accuracy is not as high as with magnetic or electrical media but could be if a smart typewriter is used to generate line checksum characters during the message composition function; data integrity of OCRs is better than that provided by present manual systems

Data recoverability is high if the media are damaged

Easy to handle and is more durable than magnetic media

State-of-the-art OCRs can tolerate (within reasonable limits)

Coffee stained, coke stained, wrinkled or dirty pages

Smudged or touching characters

Uneven character and line spacing

Uneven character print density

Variations in character stroke widths

Cloth ribbons

Type from manual OCR font typewriters

Skewed and misaligned characters and lines

Page misalignment with the typewriter

Table 2. Magnetic media evaluation summary.

High user impact; not readable by humans, require page copy and identifying labels on the media or:

Special equipment and skills are required by persons performing message chop, coordination, approval and release functions; release authority code must be magnetically encoded on the media in addition to the usual signature on the media

Require additional time, personnel and equipment at each stage where the message has to be read or its precedence, security and routing requirements have to be observed

Media are expensive and must be reused

Except for magnetic cards, only a small fraction of the media unit is used for the message

Restricted to one message per media unit to avoid conflicts during routing and approval and with both high and low precedence/security message on the same media unit

Requires approved additional equipment and procedures to erase and verify each media unit before it is submitted for reuse

Page copy is required for chop, coordinate and approval functions as changes are not easily or effectively indicated on magnetic media

Message accountability becomes a significant problem in the communications center during times of peak loading

Page copies or proof of transmission copies may become separated from the media unit and media are not directly readable by humans

High data integrity/accuracy through use of checksums, keying schemes, redundacy checks, etc.

Little chance of recovering the data if the media are damaged and the tendency would be to keep page copy also

High costs for equipment, training, maintenance and support

These media are best suited to mass storage of messages

Table 3. Electrical media evaluation summary.

High user impact

Special equipment, training and skills are required for personnel performing message chop, coordination, approval and release functions

Officers are mobile and not always near a terminal; it would be necessary for them to report to their terminals frequently to clear any pending traffic or they could be summoned by a terminal to clear a high precedence message; if this were not done, then the in basket to out basket delay would increase to that of page media and the advantage of electrical routing (high speed and elimination of messenger/mail routing) would be defeated

Electrical routing is not cost effective for low volume, low precedence message traffic unless it is part of a larger, integrated ship's command and control or management information system; quite often electrical routing is reduced in capability to being no more than an expensive electronic in/out basket; it is these circumstances a cheap metal basket would be sufficient.

Page copy is required for chop, coordinate and approval functions as changes are not easily or effectively indicated on a keyboard display terminal

High data integrity/accuracy through use of checksums, keying schemes, redundancy checks, etc.

Higher costs for equipment, training, maintenance and support than would be with magnetic or typewritten page media

High cost for both terminal and system computer software to:

Route message to the various review personnel in the correct order Notify review personnel of a pending high precedence message or of an excessive backlog of messages which needs to be reduced

Ensure that the person operating the terminal and the terminal itself are cleared for classified messages

Verify that a message has been completely and properly routed before it is released

Permit only valid release authorities to release messages

Requires installation of TEMPEST approved cables

Table 4. Media cost comparison.

MEDIA	COST ESTIMATE PER UNIT	COST ESTIMATE PER 500 MESSAGES ⁽¹⁾
Typewritten page	\$0.01/page	\$10
Magnetic ⁽²⁾		
5-1/4 inch floppy disk	\$ 7.00/disk	\$ 1.750
8 inch floppy disk	8.50/disk	2,125
hard disk	80.00/disk	20,000
tape cassette	7.00/cassette	1,750
tape mini-cartridge	18.00/cartridge	4,500
tape cartridge	19.00/cartridge	4,750
eard	1.00/card	250
Paper tape ⁽³⁾	\$ 0.50/roll	\$ 6.25
Electrical ⁽⁴⁾	very low	very low

NOTES:

- 1. This roughly represents 10 days of message traffic based on USS OKLAHOMA CITY data
- 2. Based on one message/unit, 50 messages/day, an average message length of 2100 characters, and the medium, where applicable, is available for reuse once every five days; security problems associated with reusing the medium are not considered
- 3. Assumes an efficiency use of 40 messages/roll
- 4. One time cable installation costs will be considerable

Typewritten Page (DD-173 Joint Messageform)

This medium has the advantage of being readable by humans during the message generation process and readable by an optical character reader (OCR) for the entry into an automated message preparation system after final approval. The type style on the type-written page would be a special font, readable by both humans and OCR units. OCR units can be programmed to read particular fonts. The selection of which type style to use is based on the ease with which humans can read the characters and the error rate associated with the OCR unit that must also read the characters. The Department of the Navy has specified the use of OCR-B (Reference 17). The DD-173 typewritten pages are not reusable, but they have a very low cost, they are plentiful and can be easily handled as with other paper documents. The equipment cost for preparing the medium at a single message composition station (MCS) is estimated to vary from \$800 to \$30,000 depending on the equipment used. For example, a commercial electric typewriter costing \$800 may be purchased with the appropriate type style. However, the initial cost of an MCS could be lower if the shipboard typewriters presently used have a changeable type capability and the particular OCR readable type style is available for that model typewriter. Additional costs

would be low also for logistic support of presently used typewriters. The equipment costs will be high for a keyboard/display intelligent terminal (KDIT) with a printer, up to about \$30,000 for one MCS. There are many KDITs and printers available for the commercial market costing much less than \$30,000 but these equipments are not designed for shipboard use. The costs for a fully qualified shipboard KDIT and printer may even exceed the \$30,000 depending on the total capability required.

The operator for an MCS using a typewriter would need training as a typist. If the typewriter has extra editing and special features for message composition, then extra training would be required for machine operation. If a KDIT and printer are used in the MCS, then the operator skills and training time may increase greatly over that required for typewriter use. Although a KDIT with extensive editing and special capability would require more operator skills and training time than if the ordinary typewriter was used, once acquired, the training should speed the message generation process. The exact benefits of a tradeoff of message generation time for operator training time are beyond the scope of this report. The use of operator prompting by the KDIT may reduce the time required for generation of some types of messages and also may reduce operator training time. Only one trained person is required for an MCS.

There would be no equipment or training for personnel involved with chop, coordination and release of messages over what is required at present. The message review and release personnel would be able to read the message on the DD-173 form whether it is typed on a typewriter or printed from a KDIT. There would be no additional security requirements for message handling beyond those presently in use.

Electrical Signals

This medium has the advantage of having a fast transfer between equipments and compatible signals for entry into an automated message preparation system.

The use of the electrical medium aboard ship requires that TEMPEST approved cables be installed. The cables and cable installation cost, a one time cost, would be high. The location and number of message composition stations, message handling equipments and the cable routing would need to be determined before cable installation costs could be estimated adequately.

The equipment cost for a single message composition station (MCS) is estimated to vary from \$5000 to \$40,000, depending on the equipment used. If a commercial smart typewriter is used that has storage, edit and electrical communication capability, the cost may be as low as \$5000. If a KDIT is used in the MCS, then the cost may be about \$40,000 for a shipboard qualified unit. Security approved equipment and spaces would be required for each MCS.

The operator of a MCS using a smart typewriter or KDIT would need training as a typist and machine operator, as well as special training for communication control, editing and use of message composition features. The training, once acquired, should speed the message generation process. Here again, the exact benefits of a tradeoff of message generation time for operator training time are beyond the scope of this report. The use of operator prompting by the smart typewriter or KDIT may reduce the time required for generation of some types of messages and also reduce operating time. Only one trained person is required for each MCS.

The equipment cost for a single station for message chop, coordination or release is estimated to be from \$5000 to \$35,000, depending on the equipment used. A smart type-writer or KDIT with a printer may be used for message review and release. The review and release personnel would need training in equipment operation and communication control. Changes to a message may be noted on a hard copy or entered via the keyboard on a smart typewriter or KDIT. A hard copy may be routed back to the message writer using the same delivery system as for other paper documents or the changes entered by keyboard can be transferred electrically back to a place where the message writer can view the changes on a display or obtain a hard copy. The use of operator prompting for review and release functions when changes are entered via keyboard may reduce the time required for message correction. Security approved equipment, spaces and safeguards would be required to ensure that only authorized personnel view a message.

Binary Magnetic Field on Disks, Tapes and Cards

Magnetic disks, tapes or cards are readable by the appropriate reading device for entry into an automated message processing system. The magnetic medium is not suitable for direct reading of a message by humans but, with appropriate reading and display (or printer) devices, a message can be read from it.

Magnetic disks and tapes are best suited for mass storage of messages. The storage capacity (200 to 300 messages) of a disk or tape far exceeds the requirements for an average length message. However, a tape or disk could be used as the medium for the message generation process. The storage capacity of one magnetic card is suitable for an average length message, but several cards would be required for a long message.

The equipment cost for a single message composition station (MCS) is estimated to be \$7000 to \$45,000, depending on the equipment used. If a commercial smart typewriter with a magnetic write/read unit attached is used in the MCS, then the cost may be as low as \$7000. If a KDIT with magnetic write/read unit and printer is used, the cost may go up to about \$90,000 depending on the total capability required. Security approved equipment and spaces would be required for each MCS.

The operator of a MCS would need training as a typist and equipment operator, as well as special training for use of any editing and message composition features. Once acquired, the training in the use of editing and message composition aids may speed the message composition process. The use of operator prompting by the KDIT or smart typewriter may reduce the time required for generation of some types of messages and also reduce operator training time. Only one well trained operator is required for each MCS.

The equipment cost for a single station for message chop, coordination or release is estimated to be \$7000 to \$90,000 depending on the equipment used. A smart typewriter or KDIT with magnetic read/write unit and printer may be used. The review and release personnel would need training in equipment operation and possibly typing if suggested message changes are added to the magnetic medium. Changes to a message may be noted on a hard copy of the message instead of added to the magnetic medium. The use of a reading station by review and release personnel would increase the time required for message generation above what is presently used, as well as requiring operator training time. Each person needing to review or release a message would need operator training or have an operator use

the equipment. This would increase the number of personnel involved in message operation. The use of operator prompting for review and release may minimize training and message generation time.

MESSAGE ENTRY DEVICES (MED)

Some of the most important characteristics of message entry devices are summarized in Appendices A through E. Also characteristics of equipment that may be used in message entry systems are compared to the MED characteristics.

Information about the equipments was taken mostly from sales and marketing brochures. These brochures do not supply all the information required, in which case the characteristics for that equipment were marked "INA" (information not available). The equipment manufacturers may be contacted to obtain the missing information.

Optical Character Reader (OCR) Characteristics and Equipments

The OCR characteristics of primary interest are cost, throughput, character recognition, page input requirements and suitability for Navy shipboard use. Characteristics and OCR equipments are listed in Appendix A.

Keyboard/Display Terminal (KDT) Characteristics and Equipments

The KDT characteristics of primary interest are the cost, keyboard capability, display features, compose and edit capability and suitability for Navy shipboard use. Characteristics and KDT equipments are listed in Appendix B.

Magnetic Device Characteristics and Equipments

The magnetic devices considered are read/write units for floppy disks and diskettes, hard disks, tape cassettes, tape cartridges and mini-cartridges and magnetic cards. The characteristics of primary interest are equipment costs, the memory capacity of each unit, interface control and information and suitability for Navy shipboard use. Characteristics and equipments are listed in Appendix C.

Typewriter Terminal Characteristics and Equipments

The typewriter terminals considered are keyboard/printer smart terminals. The characteristics of primary interest are cost, keyboard capability, print quality, compose and edit capability and suitability for Navy shipboard use. Characteristics and equipments are listed in Appendix D.

Printer Characteristics and Equipments

The printer characteristics of primary interest are cost, print quality and type styles, paper handling, interface control and suitability for shipboard use. Characteristics and printer equipments are listed in Appendix E.

CONCLUSIONS AND RECOMMENDATIONS

There is a wide variety of systems available commercially that could function as message generation stations. Unfortunately, none are approved for service use and there is little likelihood of any of them being approved in their present form. Putting any smart terminal with memory aboard a ship will require a development project. The advantages of using message composition stations are obvious, but the life cycle cost of such a terminal is difficult to analyze.

Having distributed smart and/or dumb display terminals with electrical routing provides the highest level of capability at the highest cost. If funds were unlimited this would clearly be the best choice. Such a system would cost well in excess of two million dollars each if it were programmed to a high level of capability. The use of keyboard printer remote terminals rather than keyboard displays would decrease the hardware cost involved, but would increase the software cost. The resultant cost would still be at least two million dollars each.

Other message composition stations (essentially word processing systems) based on magnetic media (e.g., key-to-disk, key-to-tape, key-to-magnetic card) can be designed with sophisticated editing packages that could do much to speed the actual typing of the message. Their cost would be in excess of \$90,000 each for a system for shipboard use. The maintenance and required operator training would add to the cost.

The common electric typewriter currently in service use is by far the least expensive message composition station, but it likewise has the least capability. Typewritten pages can be used as input to automatic message preparation systems using an OCR.

It should be pointed out that the message composition, staffing and releasing functions involve mostly human functions and, therefore, are not cost effective candidates for automation. Quite often, the time spent writing the first draft, researching information, staffing the message and waiting for the message to be reviewed by the appropriate personnel greatly exceeds the time spent to put the first and any subsequent drafts on a medium suitable for staffing and delivery to the communications center. Using smart terminals (e.g., keyboard display printer terminals and a fitting typewriters with magnetic memory capability) to aid in producing the message of the media provides little benefit in the overall process and, thus, is not cost effective. Not only the these smart terminals extremely expensive compared to conventional objects. The writers that also the cost for maintenance, support and training is a significant expense which also must be considered.

Typing or editing a message with consentional typewriter requires very little operator training. Changes to a message are easily accomplished by indicating where the change is being made and typing the desired change on a correction page. These correction pages are also readable by the OCR. Note that it is not necessary to retype the entire message. On the other hand, smart terminals are sophisticated devices which require extensive operator training for both officer and enlisted personnel.

Using networked smart terminals is the most expensive means of message generation and delivery and is justified only on the largest and most sophisticated ships where the terminal could be used as part of a larger integrated ship's command and control or management information system. Although networked terminals would drastically decrease the transfer time between various review personnel, they would not decrease significantly the inherent delays associated with the human functions of staffing and releasing a message. In

fact, unless the reviewing officers are sitting at or near their respective terminals for a major portion of their day, it would increase the "in basket" to "out basket" delay. Basically, it is much easier for a messenger to find an officer aboard ship than for a smart terminal to summon him. Another major problem and cost associated with using networked terminals is the implementation of the security safeguards required to ensure that only authorized personnel view a message.

Since it is desirable to have only the originator make changes to the message media, the copy returned to the originator for correction must show clearly where the changes were made and what the original text was. Using either magnetic or electrical media, this is extremely difficult to do in a manner that is either printable or displayable. From a human factors point of view, page copies are the only acceptable media for the chop and coordination cycle as any changes can be penciled in easily. This medium allows anyone viewing the message to easily see exactly what words or phrases were changed and what new phrases or paragraphs were added to the original draft and yet still allows the original draft to be read for comparison. This, of course, does not preclude the use of magnetic or electrical media altogether, but points out a significant advantage of page media.

AUTOMATED MESSAGE PREPARATION

This section is not concerned with the generation of a message, but only with its handling after it arrives at the communications center via either electronic or manual means. The section is divided into four subsections. The first subsection is a delineation of communication center functions required for the preparation, transmission and backrouting of outgoing Naval messages. It is an exhaustive delineation of all functions, not just those that are candidates for automation. As such it provides a standard gauge by which to judge the effects of various media and methods of automation on the message preparation process presently in use. In other words, when automating a particular communications center function, the medium used (be it electronic, magnetic or visual) will affect not only the automation of that function, but also the automation of other functions and the operation of functions not being automated. Thus, the effect of each automation candidate and its medium upon all communications center functions, needs to be considered when evaluating it against other candidates, whether or not they are automated, for automation and other media.

The second subsection considers each function defined here and discusses each with respect to whether it is a cost effective candidate for automation using available technology. This involves examining the effect of various media upon the automation of each function as well as various methods for automating the function. Each function is studied to determine if it is really necessary in an automated environment or if it could be handled automatically or eliminated altogether by the automation of another function. As discussed previously, the effect must be considered on the entire communication center operation of automating a particular function, not only from the aspect of making it easier or harder to prepare, transmit and backroute messages, but also making certain that security, precedence, routing and formatting requirements can be satisfied without serious impact. Any evaluation of the impact on a communications center as a result of automating one or more of its functions has to include the personnel impact as well as the operational impact. Ideally, automation of a function should reduce not only personnel requirements but also

skill level of personnel required. In most instances the former is much easier to attain than the latter due to the inherent complexity of automated equipment. A major thrust of the development of any automated message preparation system should be to make the equipment as foolproof as possible with a tutorial equipment operation mode for training purposes. This can increase development cost significantly, but will pay off in improved operator training and in easier acceptance of the system by the operational community.

The third subsection is concerned with candidate automated message preparation systems to handle the various message media and with different levels of capability. The media considered are electrical (e.g., remote terminals), magnetic (e.g., card, disk, tape) and visual (e.g., typewritten page). Each of these media has inherent advantages and disadvantages when viewed in conjunction with the automation of communications center functions. The levels of capability will refer to the set of functions to be performed automatically by the system. The lowest level of capability consists of automating those functions deemed to be the most cost effective candidates for automation. The highest level of capability includes automating all those functions deemed to be reasonable candidates. A system of the low level would be suited to a small ship with a relatively low volume of outgoing message activity, while a high capability system would be useful on a large ship with a high volume of outgoing traffic.

The fourth subsection discusses the conclusions of this study task and makes recommendations as to further system design and development.

MESSAGE PREPARATION FUNCTIONS

This section discusses the functions performed in the typical communications center for the preparation, transmission and backrouting of an outgoing Naval message. The message preparation functions are listed in Table 5. The other half of communications center functions, the receipt and distribution of messages from external systems, is not within the scope of this report.

Accept Message

The first message processing function performed by the communications center is to accept the message for external delivery. The message is brought to the communications center message delivery window by pneumatic tubes, messenger or courier where it is checked for precedence and valid release authority and then logged. Additional checks are performed for completeness, security, legibility, authenticity, etc., before the message is filed by precedence in the preparation queues. If it cannot be prepared as drafted, coordination with the originator is required to resolve the problem.

Table 5. Message preparation functions.

I Automated message preparation

- A. Accept message for external delivery via message delivery window (messenger or courier)
 - 1. Observe message precedence and handle according to established procedures
 - 2. Log receipt time of message
 - 3. Verify valid release authority
 - 4. Check message for completeness, security, legibility, authenticity, etc.

B. Prepare message for transmission

- 1. Assign DTG
- 2. Log DTG assigned (ensure DTGs are unique)
- 3. Validate message form parameters
 - a. Action precedence
 - b. Information precedence
 - c. Classification
 - d. From line
 - e. Addressees
 - f. Text
- 4. Determine security and special handling requirements (falls out of the normal flow of traffic; includes such things as off-line encryption)
- 5. Determine format and delivery circuit
- 6. Assign routing indicators
- 7. Prepare message in correct format and LMF for transmission
 - a. Narrative (normally paper tape)
 - b. Data pattern (normally card or magnetic tape)
- 8. Proofread message
- 9. Correct message
- 10. Proofread and correct message until it is determined to be correct
- 11. Place message in proper outgoing queue by precedence

C. Enter message into transmission system

- 1. Retrieve message from outgoing queue (FIFO by precedence)
- 2. Transmit message over proper delivery circuit
- 3. Obtain acknowledgement for message
- 4. Log transmission or cancellation time of message

D. Backroute message

1. Determine recipients

Table 5. Continued.

- D. Backroute message (Continued)
 - 2. Prepare message for delivery
 - a. Duplicate appropriate number of copies
 - b. Collate and staple copies
 - c. Slot message copies
 - 3. Deliver message via pneumatic tubes or messenger (communication center or department)
- E. File message
 - 1. Store proof of transmission hardcopy and paper tape of message
 - 2. File message by originator, DTG, SSN, TOF, CSN, etc.
 - a. Short term fije
 - b. Long term file

II Ancillary

- A. Maintain message files
 - 1. Maintain files based on originator, DTG, SSN, TOF, CSN, etc.
 - 2. Provide hardcopy and/or paper tape of message on request
- B. Respond to service messages and customer requests
 - 1. Determine action required
 - a. Correct message in file
 - b. Readdress message
 - c. Customer request for additional copy of a filed message
 - d. Request for retransmission of missing channel number of incomplete, misrouted or missent message
 - 2. Take action requested
 - a. Retrieve required message(s) from file(s)
 - b. Correct referenced message and redistribute
 - c. Prepare new heading, treat as new outgoing message
 - d. Reproduce and distribute additional copy
 - e. Ascertain validity of missing/incomplete message
 - 3. Prepare service message reply, if required
 - a. Obtain release authority
 - b. Enter message into transmission system
 - c. File message
- C. Maintain communications center statistics and generate reports
- D. Destroy surplus classified material

Prepare Message for Transmission

The message preparation process begins with the assignment of the date-time-group (DTG). DTGs must be logged and verified to be unique. The message form parameters are then validated. This includes the action and information precedences, classification, from line, addressees and text. Examples of problems that can occur here are: information precedence higher than action precedence, invalid classification, improper use of prosigns in the addressees and the text classification not agreeing with the stated message classification. Any problems here must be resolved by the drafter. After the form parameters are validated, the format and delivery circuit must be determined. This may depend on security and special handling requirements, such as off-line encryption. All routing indicators must be assigned and validated with respect to the message classification to ensure against security mismatches. At this point, the message is ready for preparation in the proper format and language media format (LMF) for transmission. Here the message could be narrative, which is normally prepared on paper tape, or data pattern, which is normally prepared on punched card or magnetic tape. Usually the message is prepared at a teletypewriter and sent to a proofreader for verification. If the message is not correct, it is sent back to a teletypewriter operator for correction. This process of proofread and correct can go to several iterations before a correct message copy is produced. The message then is placed in the proper outgoing queue for transmission by precedence.

Transmit Message

Entering the message into the transmission system involves retrieving it from the outgoing queue. The queues are set up by precedence and the highest precedence message is retrieved first. Within a precedence queue, the messages are retrieved first-in-first-out (FIFO). Each message is transmitted over the proper delivery circuit, normally a HF or satellite relay radio link. A positive acknowledgement must be received for each message transmitted and channel sequence numbers (CSNs) must be updated. After transmission, the transmission or cancellation time must be recorded for message accountability.

Backroute Message

Backrouting of the message after transmission is an important function of the communications center. The drafter always wants proof that the message sent is transmitted and wants a copy of it as transmitted for the drafter's files. Also, messages are normally identified by the DTG assigned by the communications center and the drafter must be given this information. The recipients of a backrouted copy must be determined and an appropriate number of copies duplicated, collated, stapled and slotted for delivery via pneumatic tubes, messenger or courier.

File Message

In addition to backrouting, a proof of transmission hard copy and paper tape of each message must be filed for later use. These copies would be used later if a message was required to be transmitted or addressed. The messages are filed by originator, DTG, station serial number (SSN), time of file (TOF), and/or channel sequence number (CSN). Normally,

two message files are used, a short term file and long term file. The short term file generally contains only those messages transmitted during the previous 30 days; the long term file may hold a message copy for a year or more.

Perform Ancillary Functions

In addition to the normal functions of message acceptance, preparation, transmission, backrouting and filing, a ship's communications center typically performs other functions. These ancillary functions are to maintain message files, respond to service messages and customer requests, maintain communication center statistics and generate reports and destroy surplus classified material.

File Maintenance

Both short term and long term message files must be maintained and updated periodically to eliminate old messages from the long term file and to transfer out of date messages from the short to the long term file. Communications center personnel must be able to retrieve messages from either short or long term files based on some combination of important message parameters such as originator, DTG, SSN, TOF, CSN, etc. Retrieved messages are usually provided in the form of a proof-of-transmission hardcopy and/or the actual paper tape of the message entered into the transmission system.

Customer Requests

A ship's communications center must respond to service messages and customer requests. Requests may be made to correct a message in the file, readdress a message, provide an additional copy of a message or to retransmit a missing, incomplete, misrouted or missent message. The communications center responds first by retrieving the required message from the file and then by performing the actions requested. The action performed may be to correct and redistribute the referenced message; prepare a new heading and treat as a new outgoing message, if a message is being readdressed; reproduce and distribute an additional copy; or ascertain the validity of a missing/incomplete message. Also, it may be necessary to generate a service message reply. If so, it must be handled and processed as a normal message including obtaining a proper release authority.

Record Keeping and Reporting

For accountability purposes, message statistics are maintained by the communications center. These statistics are used in generating offship reports or messages and include, at a minimum, the total number of messages transmitted, the total number of messages cancelled or rejected, the existence of any large outgoing queues and the loss of any processing capability. More detailed statistics may be maintained for on-ship reports. These reports are used for historical and statistical analysis purposes. On-ship reports typically include measurement of system throughput performance and a statistical analysis of message precedence, classification and length as related to circuit, throughput times and accuracy.

File Destruction

Destruction of surplus classified material in a communications center is an important and necessary function. The long term message file is usually purged annually to make room for more recent messages. Excess hard copies and paper tape copies are sometimes generated during the message preparation process. All of this classified paper material, as well as the other forms of classified material such as punched cards, magnetic media 'electronics and typewriter ribbons, must be properly destroyed.

NAVAL MESSAGE PREPARATION FUNCTIONS ANALYSIS

Each function delineated in the preceding section is discussed here in the context of its suitability for automation and the effect of different automation methods and media upon the ability of the communications center to perform the function. Each function is discussed also in the context of the automation of other areas and the effect of the media on performing the function if it is not automated. The intention here is to determine a kernel set of functions, which can be automated for various media at a minimal cost. These functions should be automated in any message preparation system developed for the fleet. A system designed to perform this set of functions would be suitable for a small to medium size ship with a moderate outgoing message traffic load and would have a high performance/ cost ratio. As more functions are added to the kernel set, more capability is required of the supporting automated system, and the cost and complexity rises. At a certain point, adding additional functions causes a rapid increase in cost and complexity with relatively little increase (or perhaps a decrease) in operational capability. After the kernel set is determined, additional sets of functions of higher cost/performance ratios can be specified. Systems to perform these additional functions automatically, in addition to those of the kernel set, could be justified only on ships with heavy loads of outgoing traffic. Automation of functions usually results in previously unrealizable added benefits at little or no additional cost. During this analysis, added capabilities will be discussed that do not exist in the present manual system.

Message Acceptance

The acceptance of a message by the communications center for external delivery is a function that can not be automated easily. It is possible to automate various subfunctions depending on the media chosen. The primary subfunction or steps considered here are the logging, verification of release authority, special handling for precedence and the check of the message for validity. The analysis will discuss each media candidate with respect to each of these steps.

Magnetic Card Media

The use of magnetic cards as message input media does allow some limited automation of the message acceptance process, but complicates the process somewhat. Assume we use a magnetic card holding up to 50 lines of text, generated by a separate composition system centrally located or located in several of the ship's areas. The cost, of course, of multiple sophisticated magnetic card message composition stations for a single ship would be significant.

Acceptance of the message by the communications center would be complicated by the fact that the magnetic card is not visually readable and any long message would require more than one card. If the cards are to be reused, the drafter would be restricted from writing on the card with a pen or pencil to identify it. If the cards are not to be reused. their cost (estimated at \$1 each) would be prohibitive. Thus, either a paper copy of the message would have to accompany the magnetic card(s) to the communications center, or at each stage where the message must be visually inspected, a magnetic card reading station would have to be provided with a display and/or printer for output. The use of a paper copy of the message attached to the magnetic cards by some method would raise the possibility of mismatching page copies with magnetic copies either at the composition station or at the communications center. At a busy communications center handling hundreds of messages a day, this could be a significant problem, especially at times of peak loadings when 200 or more messages may be received in an hour. This would be compounded by a message that may require two or more cards. If the second card of a message is misplaced, verifying which one of the several hundred in the communications center is the right one would be a time consuming task as they are not readable visually. This problem of message accountability is a problem common to all magnetic media (card, tape cassette, disk). Special procedures and equipment would be required within any communications center using magnetic media as the prime message input media.

A device could be placed at the message delivery window to log the message, verify its release authority and sort it according to precedence. The logging could be done on the card magnetically, on a separate medium, or both. Verifying the releasing authority would have to be done by assigning each releaser code to be placed magnetically on the message card. This would require the releaser to have his own card reader/writer terminal where all messages would have to be reviewed. Security procedures, to ensure that only the releaser would be able to encode the release authority on the card, would have to be formulated and implemented. Sorting the messages according to the precedence could be done easily by a reading station at the message window, but this is not a significant problem in the present manual system.

It would be very difficult to automate using magnetic cards or any other media to check the message for completeness, security, legibility, authenticity, etc. This is one function that requires a human to inspect the message visually. The use of magnetic cards would complicate the performance of the function by communications center personnel because a read station is required to verify the contents of the card. Since there is no guarantee that identifying information written on the label of a magnetic card agrees with the data written magnetically on the card, either this condition is going to have to be accepted as a risk that will have to be taken, or reading stations will have to verify the contents of message cards at various stages. This is a particular problem when verifying a valid release authority if this is not done by a magnetic code. To be reused, the card must be large enough for several signatures or have labels that can be peeled off. Neither of these solutions will provide the same level of accountability as the present manual system with each typewritten page used and signed only once.

Another problem with magnetic cards is that they are relatively fragile compared to the page copy presently used in the message preparation process. Magnetic cards do not respond well to bending, folding, spindling, scratching or other forms of mutilation that are not uncommon. When a card is rendered unreadable, this necessitates a fallback to the page

copy for a retype. This would require a composition station in the communications center to redraft the message. This redraft is not presently required and would detract from the advantages of automated message preparation.

Magnetic Tape Media

The magnetic tape media available are the cartridge, mini-cartridge, cassette and mini-cassette. All have sufficient storage capacity for any anticipated message and differ primarily in size and cost (estimated at \$7 to \$19 each). Due to their cost, they must be reused and thus they share the disadvantages of the magnetic card with respect to accountability. They who are bulkier. Reusing the magnetic media will require security procedures to be established and implemented to ensure no classific data are subject to compromise.

The magnetic tape media also are not visually readable and thus would require multiple read stations in the communications center to verify their contents. Magnetic tapes are not as fragile as magnetic cards, but would still require special handling both inside and outside of the communications center.

The primary advantage of magnetic media is that they are easily read by electro-mechanical means. By the use of checksums, keying schemes and redundancy checks, the integrity of data can be checked easily. Thus there is little possibility of any unintentional changes being made to a message after it has been released. Using magnetically coded release authority, changes to a message can be effectively prohibited after its release. Unless there is a failure in the reading equipment, the drafter can be assured that exactly what was coded on the tape will be transmitted. Due to the fact that humans now do the vast majority of ships message preparation, the present system always admits the possibility of unintentionally changing a word or phrase in a message that could significantly after its interpretation by the recipient. This problem can be effectively eliminated through automation.

Visual Media (Typewritten Page)

The typewritten page (DD-173 or equivalent) is the medium presently used for shipboard message preparation. Automation using page copies would require the use of an optical character reader (OCR). These devices presently have wide use in banks, publishing companies, newspapers, etc., as well as in shore based communications centers. OCRs require the use of special OCR typewriter fonts that are presently available only on electrical typewriters.

The use of page media would have no effect on the present communications center function of accepting the message for external delivery as they are the present media used. Automatically logging the receipt time of a message could be done using OCRs, but would require an extra reader at the message delivery window and is not likely to be worth the cost.

Electrical Media

Message delivery to the communications center via electronic means would allow the same level of automation as magnetic media. This assumes the use of multiple intelligent terminals at various locations on a ship. Their cost alone would preclude their use on any but the largest and most sophisticated ships where they could be used as part of a larger integrated ships command and control or management information system.

Electronic delivery would certainly speed the delivery of a message to the communications center. However, it would require security procedures to encode the valid release authority on the message. The TEMPEST considerations of having these terminals generate top secret or secret messages and transfer them to the communications center electronically could make the cost of these prohibitive on any ship. This approach would have by far the greatest impact upon existing ships procedures and require extensive training of ship's personnel to use the intelligent terminals effectively.

Conclusions

The functional area of the communications center that accepts messages is not an area ripe for automation. As mentioned previously, the use of magnetic or electronic media would complicate the acceptance process by requiring new security procedures to verify a valid release authority. Automating the acceptance function does not appear to be cost effective and any automation of other functions should strive to impact on this function as little as possible.

Message Preparation

The function area where the media information is converted into a format that can be transferred to existing transmission systems to be sent to external addresses can benefit greatly from automation. Here the medium is either visual, magnetic or electrical and the information is formatted into either JANAP 128, ACP 127 or ACP 126 (modified). It is transferred electrically to a transmission system (e.g., NAVMACS) or transferred to paper tape for delivery over existing transmission facilities.

The message preparation is relatively unaffected by the message media chosen. The first step would be to convert the message into binary data via some sort of reader or input device. Thus the main media consideration for this function is how reliably and easily may they be converted into binary electrical data. If the media are electronic, they are already in the proper form. Magnetic media are easily converted into binary electrical data. This conversion can be made quite reliable through redundancy and data checks, and keys can be encoded to ensure data integrity. Visual media in the form of a typewritten page can be read reliably using the proper typewriter font and an OCR. Using conventional typewriters, checksums and other such datachecks is not easy to do on an OCR. There is little possibility of an OCR matching the levels of data integrity that can be achieved using magnetic or electrical media. Normally, OCR errors are either rejects or substitutions. Rejects must be corrected by the operator, whereas substitutions are not detectable. Substitutions are, however, only character errors, not word or phrase errors. OCRs are now reliable enough to have specifications of no more than one substitution in 1,000,000 characters. This is much better than the present combination of manual preparation and message transmission via radio. Taken in this context, substitutions are not considered to be a serious problem.

Using intelligent typewriters for message generation, an OCR could closely approach the data integrity of magnetic readers. To do this the typewriter would calculate and place a line checksum character in one of the margins. This could be done at the time the final clean copy is produced. This would solve the substitution problem but would defeat a major advantage of OCRs over magnetic media: The OCRs require no new sophisticated equipment outside of the communications center, while magnetic or electrical media both require expensive terminals at various locations on each ship.

The steps for the message preparation function that could be automated in the communications center are:

- 1. Assign and log unique DTG
- 2. Validate message form parameters (e.g., precedence, classification, originator, addressees, text)
- 3. Determine format and delivery circuit
- 4. Assign routing indicators as needed
- 5. Prepare message in correct format and LMF
- 6. Place message in proper outgoing queue by precedence (on-line interface only)

An automated message preparation system proposed for shipboard use should be able to perform these steps to at least a limited degree, as they are well suited to automation. A major advantage in automating these steps is that automation eliminates the manual prepare (reformat/retype), proofread and correct steps of the present method. These steps are the most time consuming and require the most personnel training, as well as being very fertile areas for errors.

Message Backrouting

The automation of the message backrouting function can be done on a fully automated message processing system where it can be combined with the routing of incoming messages. Automating this function would be possible only on large ships where such an expensive system can be justified. Such a system would use electronic media for message delivery to the communications center. This hardware then would exist already for backrouting (i.e., keyboard displays and printers) and it would require only the generation of control software to automate the backrouting function. The main problem with this type of system is the cost. The capability provided could be very useful, but it is questionable that the incremental increase in capability is worth the great increase in cost over less costly systems with less capability based on other media.

Magnetic media would allow a form of automated backrouting as the messages could be duplicated automatically on cards and manually distributed. Marking the cards for proper delivery would be a problem and would probably require a separate sheet to identify the recipients. It would require reading stations to be available to everyone receiving a backrouted copy. Having more than one message per magnetic media unit (card, tape or disk) would be a problem, so the major advantage of magnetic storage (i.e., data compression) would be largely defeated. Due to this a page copy of the message would be far more practical for backrouting in this case as it is more compact and easily readable.

Use of OCRs would not affect the backrouting function, so any automatic or semi-automatic backrouting system presently considered for shipboard use (e.g., message reproduction and distribution system (MRDIS)) would be compatible with OCRs.

Message Filing

Maintaining outgoing message files is a relatively easy task if an automated message preparation system is used. For large systems, the files can be maintained on magnetic disk (30 days traffic). Small to medium size systems would operate best with magnetic tape

storage. The tradeoff is in the area of cost/performance as disk units are very expensive compared to tape units, while for the extra money, they deliver much faster performance. Disk units can retrieve messages in milliseconds, while tape units may require minutes to perform the same task. It is likely that in the future, advanced technologies such as bubble memory will replace all disk and tape units. These technologies will be totally electronic with no moving parts. Presently, they are too expensive for mass storage use, but their cost is expected to be competitive within the next ten years. Their primary advantage is minimal space requirements with almost total reliability.

Customer Requests

The responding to customer requests, whether from tenant or from external commands, is a fertile area for semi-automation. Most customer requests require only the manipulation of the data contained in the message file and, therefore, the access of the data base is the primary area to be automated.

Requests from external commands normally involve service messages that notify the communications center of a communications problem. This involves either the reject of a message due to a format error or the garbling of a message due to radio interference. The response would be the correction and/or retransmission of the subject message. The use of an automated message preparation system should practically eliminate message rejects, thus reducing retransmission requirements. Through the use of a keyboard display terminal or an operator's console on the message preparation system, an operator could recall the message from the message file and either retransmit it via the automatic transmission system or output the message on paper tape for delivery via another circuit. The operator also should have the capability to generate short messages at the console. This could be to generate service messages or high precedence traffic in emergency situations.

Requests from tenant commands are usually for a message copy or to readdress a message in the communication center files. These could be done automatically or semi-automatically. The readdress request could be prepared on the normal input media and processed as a regular message. In this case, the message preparation system would recognize the request, search its files and readdress the message as per the request. If the message is not contained in the files, of course, the operator would have to intervene. Semi-automatic operation could be done by the operator requesting a papertape copy of the message from the message files, preparing a new header via the message preparation system and then splicing the two together and transmitting the resulting message.

Maintain Statistics

The compilation of message statistics is a time consuming but necessary task performed by the communications center. These statistics would include, but not be limited to, the number of:

- 1. Messages transmitted and received broken down by precedence
- 2. Line blocks transmitted and received
- 3. Cancelled messages
- 4. Rejected messages

Using automated message processing, these statistics can be updated easily on a real time basis and output on request to an operator's console or printer.

Destroy Surplus Classified Material

There is little possibility that increased automation would have a significant beneficial impact in this area. As mentioned previously, the use of magnetic and electrical media raise serious security problems. All classified data on a piece of magnetic medium, or contained in the memory of an intelligent terminal, must not be subject to compromise. The more intelligent terminals and magnetic media stations there are on a ship, the more of a problem this becomes.

Message Preparation System Rating Criteria

As can be seen from the preceding sections, the problem of how to best automate the outgoing message process function is not a simple one. The impact of each facet of the system's design on ships' operation needs to be examined and evaluated. Many systems look very promising in the initial proposal stage but would create hosts of administrative and operational problems if implemented in their entirety.

The problem of evaluating different system approaches and media boils down to deciding what are the important criteria for differentiating between systems and approaches. During this period of skyrocketing costs and limited defense budgets, total system cost must be considered as well as the cost-to-performance ratio. Realistically, the Navy must do a better job on a severely restricted budget, and cannot afford the luxury of multimillion dollar high performance message processing systems on every medium to large size ship. Therefore, the primary criterion must be to gain a maximum benefit in decreased writer-to-reader time using a minimum amount of hardware (i.e., money).

The second most important criterion must be the impact of the proposed system upon the present manual message preparation and transmission system. This covers many of the hidden costs and benefits of implementing a new system. Ideally, automating message preparation should have no negative impact on ships' operations. The operational community is reluctant to change procedures in any way that may shift burdens from one department to another. Thus, systems that impact the least must be considered more desirable than those with heavy impact.

Another criterion is to have a system that is easily developed. This involves the hardware, software, documentation and training courses required for a particular system. This, of course, is related to the cost and impact discussed above, but the primary emphasis here is on the risk and size of the project. The risk factor in a project generally rises faster than the project's relative magnitude and depends on how much of the project requires developing new hardware or software that has no close analogy in existing systems. A message preparation system development could be structured to be a low risk effort.

MESSAGE PREPARATION SYSTEMS

Most of the outgoing message preparation functions discussed previously are candidates for automation. Some functions are relatively easy and inexpensive to automate and provide a very significant improvement in communications center efficiency (i.e., reduced message preparation time, errors and personnel/skill levels). Other functions are relatively

more difficult and expensive to automate and would be justified only for very large ships. Eventually, a point is reached where automation of some functions is no longer cost effective and provides little improvement in overall communications center efficiency. This is particularly true of those functions required in the processing of less than five percent of the total number of outgoing messages.

AMPS Functional Capabilities

Four levels of increasing capabilities, cost and complexity for an automated message preparation system (AMPS) are discussed next. Succeeding levels contain the same automated functions as earlier ones, as well as additional new functions. Hardware configurations and extimated hardware/software costs are listed for each medium type within each AMPS level. The media types considered are magnetic (e.g., card, tape, disk), visual (e.g., typewritten page) and electrical (e.g., remote dumb or smart terminal).

AMPS I

AMPS I is defined as the basic outgoing message preparation system. It automates those functions within a communications center which require the most personnel and are characterized as being the most time consuming and prone to human error. In particular, it automates the preparation of a message for transmission. Other outgoing message processing functions are accomplished manually, semi-automatically or by systems such as the naval modular automated communications system (NAVMACS) or the message reproduction and distribution system (MRDIS).

The capabilities required of an AMPS I are:

1. Input messages:

- Automatically read a DD-173 (or equivalent) formatted message via a magnetic media reader (card, tape, disk) or OCR (Typed DD-173).
- Automatically read a paper/mylar tape message prepared in DD-173 (or equivalent) format and coded in either ASCII or ITA#2. This is intended primarily for a fallback mode of operation.
- Accept multipage messages of less than seven pages prepared in DD-173 (or equivalent) format on the keyboard display terminal (KDT). This is intended primarily for high precedence traffic in emergency situations or as a fallback mode of operation. The main function of the KDT is to serve as the operator's console.
- Accept multipage messages of less than seven pages prepared in DD-173 (or equivalent) format on a remote KDT. The function of the KDT is to serve as a remote terminal for message composition, review, release and delivery of high precedence traffic from a secure space.
- 2. Automatically check/validate header and classification information input in 1 above. When validation errors are detected, an indication is displayed to the operator and controls are provided for manual correction when authorized.

- 3. Automatically assign the date-time-group (DTG), station serial number (SSN) and/or time of file (TOF), or accommodate manual assignment via the KDT as selected by the operator. Ehsure automatically assigned DTGs are unique.
- 4. Automatically format the data resulting from 1, 2 and 3 above into ACP 126 modified plaindress or abbreviated plaindress message format as selected by the operator.
 - 5. Automatically output the formatted message:
 - Electrically over a cable to NAVMACS
 - On paper/mylar tape from the paper tape punch (PTP) in either ITA=2 or ASCII codes.
- 6. At the option of the operator, the message being processed is listed on the line printer (LP) for a proof-of-transmission copy and/or a journal record of important message parameters is listed for accountability and logging of message traffic.
- 7. Automatically compile message statistics indicating numbers of messages processed by precedence and classification and number of messages cancelled or rejected. Output these statistics to the LP when requested by the operator.
 - 8. Permit editing of header line information via the KDT upon request.
- 9. If an OCR is the primary message input device, permit automatic editing of a typed DD-173 message form on a line group basis through use of a typed DD-173 correction page.
- 10. Provide query/response interaction with the operator. The KDT displays instructional messages identifying key selectable options.
- 11. Provide both on-line and off-line system self-test features to aid in fault isolation.
- 12. Semi-automatically section the message in accordance with the selected message format.

AMPS II

AMPS II is the most cost effective level of the four levels of capabilities being considered. In addition to the capabilities of an AMPS I, AMPS II automates routing indicator (RI) assignment for plain language addresses (PLA) and address indicator groups (AIG), message filing and retrieval functions, and formatting of JANAP 128, ACP 127 and ACP 126 messages.

Specifically, AMPS II has the following additional capabilities:

- 1. Automatically check/validate addressee and classification information contained in the input format. When validation errors are detected, an indication is displayed to the operator and controls are provided for manual correction when authorized.
- 2. Automatically assign a RI to each PLA according to the security classification level and the format of the message. Inhibit RI assignment for PLAs designated to be serviced by mail or courier. Provide the operator with the capability to correct a misspelled PLA via the KDT.

- 3. Automatically assign the required RIs to a minimum of 5 AIGs.
- 4. As selected by the operator, automatically format the input message data into either plaindress or abbreviated plaindress for one of the following message formats:
 - JANAP 128
 - ACP 127
 - ACP 126
- 5. Automatically create a history file containing a complete copy of all messages transferred to NAVMACS and/or PTP as well as a journal file for accountability and logging of message traffic. The history file and the journal file should be maintained as separate storage files.
- 6. Provide non volatile file storage for a minimum of 200 50-character PLAs, each of which may have two 7-character RIs (primary and security alternate) along with a security indicator for each RI.
- 7. Provide non volatile file storage for a minimum of five 50-character AIGs and associated RI lists. A RI list for an AIG may contain up to 500 RIs. Storage for a minimum of 500 seven-character RIs is required.
- 8. Load or update (operator selectable) the PLA/RI and/or AIG/RI data source file from the paper tape reader (PTR) or KDT in an off-line mode.
 - 9. On request, output the PLA/RI and/or AIG/RI file:
 - To the LP in alphabetical order
 - To the PTP (either ASCII or ITA#2) in a format suitable for loading the data source files as specified in 8 above.
- 10. Provide off-line message retrieval from the history file and output the retrieved message to the LP and/or PTP as requested. Messages are retrieved based on any one or any combination of DTG, SSN and TOF.
- 11. Provide off-line retrieval from the journal file to obtain a hardcopy printout of an entire day's log.
- 12. Provide the capability to add, where authorized, message handling instructions to the message header format lines.

AMPS III

The capabilities of AMPS III are essentially the same as the outgoing message processing capabilities of NAVMACS V4 with MRDIS. AMPS III has the capabilities given below in addition to those previously listed for AMPS I and AMPS II:

- 1. Automatically read a DD-173 (or equivalent) formatted message via a punched card reader or a magnetic media reader (input device may be remotely located).
- 2. Accept multipage messages of any length prepared in DD-173 (or equivalent) format from an additional local KDT (not the operator's console).
- 3. Ensure all assigned DTGs are unique, including those assigned manually by the system operator and those appearing on the message input media.

- 4. Automatically assign a RI to each PLA according to the LMF of the message and the delivery circuit required for transmission.
- 5. Automatically segment the message in accordance with the selected message format.
- 6. Automatically section the message in accordance with the selected message format.
- 7. Automatically add message handling instructions to the message header format lines based on the routing information contained in the PLA/RI and AIG/RI files.
- 8. Automatically convert the input message data into ACP 126 modified or JANAP 128 data pattern format upon request.
- 9. Automatically determine format and delivery circuit and place the formatted message in the proper outgoing queue by precedence.
- 10. Automatically retrieve the formatted message from the outgoing queue (first-in-first-out (FIFO) by precedence) and transmit over the proper delivery circuit. Obtain acknowledgement for the message and log the transmission or cancellation time.
- 11. Provide the capability for modifying and automatically retransmitting a message contained in the history file.
- 12. Provide the capability for automatically readdressing a message contained in the history file.
- 13. Retrieve messages from the history file based on any one or any combination of DTG, SSN, TOF and originator's PLA.
- 14. Automatically compile detailed message statistics for the purpose of automatically generating on-ship and off-ship communications reports or messages.
- 15. Using the input message data, automatically fill in the blanks of preformatted messages. Provide non volatile storage for a minimum of 50 canned messages with an average length of 1500 characters. Generation/maintenance of the canned messages is performed from the additional local KDT.
- 16. Automatically determine recipients of backrouted message from the input message form.
- 17. Automatically prepare copies of messages to be backrouted. This includes duplicating the appropriate number of copies and collating, stapling and slotting the message copies.

AMPS IV

Basically AMPS IV has the same outgoing message processing capabilities as the NAVMACS V5 with MRDIS or the message processing and distribution system (MPDS). AMPS IV utilizes remotely located, networked KDTs for the message composition, staffing, releasing and delivery functions. It also uses remote LPs for electronic delivery of messages being backrouted.

AMPS IV has the following capabilities in addition to the capabilities of AMPS I, AMPS II AND AMPS III:

- 1. Accept multipage messages of any length prepared in DD-173 (or equivalent) format from:
 - Two local KDTs
 - Eight (maximum) remote KDTs

Besides composition of narrative and pro forma messages, the remote KDTs also may be used for message staffing, releasing and delivery functions and for requesting additional copies of messages contained in the history file.

- 2. Automatically accept messages for external delivery that are generated at remote KDTs. This includes observing message precedence and handling according to established procedures, checking to ensure that the message has been properly staffed, checking for a valid release authority and logging the receipt time of the message at the communications center.
- 3. Automatically distribute/deliver backrouted message copies and requested message file copies to the proper remote LPs (13 LPs maximum).
- 4. Provide the required security safeguards to ensure that remote KDTs and LPs are cleared to handle classified messages and to ensure that only authorized personnel view a message.

AMPS Cost Comparisons

Table 6 lists the general types of equipment used in an AMPS along with the nomenclature of equipment approved for service use and the estimated cost of the equipment. For comparison purposes, Tables 7 through 10 list the hardware configurations and estimated hardware and software costs for each media type within each of the four AMPS levels. Only equipment costs and software development and documentation costs are shown. Since system costs incurred outside as well as inside the communications center are dependent on the media chosen, the costs for message composition stations are shown also. Costs for detailed system design, assembly, installation, documentation, OPEVAL, maintenance, support, training, etc., are unknown. It should be noted that these costs increase exponentially as system complexity increases.

The estimates presented in this section do not compromise a proposal. Instead, they are meant to serve only as a basis for comparing the relative complexities of the different AMPS levels and the impact of the media used. Due to the increased system complexity brought about by using electrical media, costs for electrical media are not shown except in AMPS IV. Using magnetic or visual media in AMPS IV essentially reduces it to an AMPS III level of capability.

Table 6. AMPS equipment list.

Equipment Type	Characteristics	Nomenclature	Cost
Central processing unit (CPU)	8-bit computer with 64K of ROM/ RAM memory 6 input/output (I/O) ports		S 30K
СРС	16-bit computer with 64K of ROM RAM memory and 7 I/O ports	AN AYK-14(V)	60 K
CPU	32-bit computer with 128K of core memory and 1 I/O controller	AN/UYK-7	550K
CPU	32-bit computer with 208K of core memory and 2 I/O controllers	AN/UYK-7	865 K
Keyboard display terminal (KDT)		AN/USQ-69	16 K
Paper tape reader/ punch (PTR/R)		RD-397/U	17 K
Line printer (LP)		TT-624(V)/UG	23K
Cartridge magnetic tape unit (CMTU)	Contains four cartridge drives	AN/USH-26(V)	23K
Magnetic tape unit (MTU)	120 inches per second; four reel-to-reel tape drives	RD-358	125K
Magnetic disk unit (MDU)	Contains four drives	RD-281/UYK	400K
Punched card reader (PCR)			20K
Optical character reader (OCR)			50 K
Magnetic media message verification terminal (MMMVT)	Smart terminal with keyboard, display, magnetic media device, CPU and validation software		66 K
Electrical media message verification terminal (EMMVT)	Dumb terminal with keyboard and display; used only with AMPS IV due to complexity of using electrical media	AN/USQ-69	16 K

Table 6. Continued.

Equipment	Characteristics	Nomenclature	Cost
Magnetic media message composition terminal (MMMCT)	Smart terminal with keyboard, display, printer, magnetic media device, CPU and editing and release authority control software		\$ 89 K
Visual media message composition terminal (VMMCT)	Electric typewriter with 10 and 12 character pitch, OCR-B font and once-only polyethylene ribbon	Selectric II	1 K
Electrical media message composition terminal (EMMCT)	Dumb terminal with keyboard, display and line printer; used only with AMPS IV due to complexity of using electrical media	AN/USQ-69 TT-624(V)/UG	39K
Magnetic media reader (MMR)			20K
Message reproduction and distribution system (MRDIS)			125 K

Table 7. AMPS I hardware and software costs.

EQUIPMENT TYPE, NOMENCLATURE	MAGNETIC MEDIA			JUAL EDIA	ELECTRICAL MEDIA	
AND UNIT COST	QTY	COST	QTY	COST	QTY	COST
CPU. \$30K	1	\$ 30K	1	\$ 30K		
CPU, AN/AYK-14(V)						
CPU, AN/UYK-7, \$550K						
CPU, AN/UYK-7, \$865K						
KDT, AN/USQ-69, \$16K	2	32K	2	32K		
PTR/P, RD-397/U, \$17K	1	17K	1	17K		
LP, TT-624(V)/UG, \$23K	1	23K	1	23K		
CMTU, AN/USH-26(V), \$23K						
MTU, RD-358, \$125K						
MDU, RD-281/UYK, \$400K						
PCR, \$20K						
OCR, \$50K			1	50K		
MMMVT, \$66K	1	66 K				
EMMVT, AN/USQ-69, \$16K						
MMMCT, \$89K	2	178K				
VMMCT, SELECTRIC II, \$1K			4	4K		
AN/USQ-69, EMMCT, TT-624(V)/UG, \$39K						
MMR, \$20K	1	20K				
MRDIS, \$125K						
COST SUMMARIES						
BASIC SYSTEM HARDWARE		366K		156K		
SOFTWARE DEVELOPMENT						
AND DOCUMENTATION		200K		200K	ļ	ļ
SYSTEM DESIGN		*		*		
SYSTEM ASSEMBLY	-	*		*		
SYSTEM INTEGRATION AND TESTING		*		*		
SYSTEM DOCUMENTATION	ļ	*	_	*		ļ
SYSTEM INSTALLATION		*		*		
LIFE CYCLE SUPPORT		*		*		
HARDWARE AND SOFTWARE COSTS		566 K		356K		

^{*}Unknown

Table 8. AMPS II hardware and software costs.

EQUIPMENT TYPE, NOMENCLATURE	MAGNETIC MEDIA		VISUAL MEDIA		FLECTRICAL MEDIA	
AND UNIT COST	QTY	COST	QTY	COST	QTY	COST
CPU, \$30K						
CPU, AN/AYK-14(V)	1	S 60K	1	S 60K	-	
CPU, AN/UYK-7, \$550K						
CPU, AN/UYK-7, \$%65K						
KDT, AN/USQ-69, \$16K	2	32K	2	32K		
PTR/P, RD-397/U, \$17K	1	17K	1	17K		
LP, TT-624(V)/UG, \$23K	1	23K	1	23K		
CMTU, AN/USH-26(V), \$23K	1	23K	1	23K		
MTU, RD-358, \$125K						
MDU, RD-281/UYK, \$400K						
PCR, \$20K						
OCR, \$50K			1	50K		
MMMVT. \$66K	1	66K				
EMMVT, AN/USQ-69, \$16K						
MMMCT, \$89K	3	267K				1
VMMCT, SELECTRIC II, SIK			6	6K		
AN/USQ-69, EMMCT, TT-624(V)UG, \$39K						
MMR, S20K	1	20K				
MRDIS, \$125K						
COST SUMMARIES						
BASIC SYSTEM HARDWARE		508K		211K		
SOFTWARE DEVELOPMENT AND DOCUMENTATION		400K		400K		
SYSTEM DESIGN		*		*		
SYSTEM ASSEMBLY		*		*		
SYSTEM INTEGRATION AND TESTING		*		*		
SYSTEM DOCUMENTATION		*		*		
SYSTEM INSTALLATION		*		*		
LIFE CYCLE SUPPORT		*		*		
HARDWARE AND SOFTWARE COSTS		908K		611K		

^{*}Unknown

Table 9. AMPS III hardware and software costs.

EQUIPMENT TYPE, NOMENCLATURE	MAGNETIC MEDIA		VISUAL MEDIA		FLECTRICAL MEDIA	
AND UNIT COST	QTY	COST	QTY	COST	QTY	COST
CPU, S30K						
CPU,AN/AYK-14(V)						
CPU, AN/UYK-7, \$550K	1	\$ 550K	1	S 550K		
CPU, AN/UYK-7, \$865K						
KDT, AN/USQ-69, \$16K	3	48K	3	48K		
PTR/P. RD-397/U, \$17K	1	17K	1	17K		
LP, TT-624(V)/UG, \$23K	1	23 K	1	23K		
CMTU, AN/USH-26(V), \$23K						
MTU, RD-358, \$125K	1	125K	1	125K		
MDU, RD-281/UYK, \$400K	1	400K	1	400K		
PCR, \$20K	1	20K	1	20K		
OCR, \$50K			1	50K		
MMMVT, \$66K	2	132K				
EMMVT, AN/USQ-69, \$16K						
MMMCT, \$89K	6	534K				
VMMCT, SELECTRIC II, \$1K			12	12K		
AN/USQ-69, EMMCT, TT-624(V)/UG, \$39K						
MMR, \$20K	2	40K	1	20K		
MRDIS, \$125K	1	125K		125K		
COST SUMMARIES						
BASIC SYSTEM HARDWARE		2014K		1390K		
SOFTWARE DEVELOPMENT						
AND DOCUMENTATION		1500K		1500K		
SYSTEM DESIGN		*		*		
SYSTEM ASSEMBLY	<u> </u>	*		*		
SYSTEM INTEGRATION AND TESTING	ļ	*		*		
SYSTEM DOCUMENTATION		*		*		
SYSTEM INSTALLATION		*		*		
LIFE CYCLE SUPPORT		*		*		
HARDWARE AND SOFTWARE COSTS		3514K		1890K		

^{*}Unknown

Table 10. AMPS IV hardware and software costs.

EQUIPMENT TYPE, NOMENCLATURE	MAGNETIC MEDIA		VISUAL MEDIA		ELECTRICAL MEDIA	
AND UNIT COST	QTY	COST	QTY	COST	QTY	COST
CPU, \$30K						
CPU,AN/AYK-14(V)						
CPU, AN/UYK-7, \$550K						
CPU, AN/UYK-7, \$865K					1	\$ 865K
KDT, AN/USQ-69, \$16K					3	48K
PTR/P. RD-397/U. \$17K					1	17K
LP, TT-624(V)/UG, \$23K					6	138K
CMTU, AN/USH-26(V), \$23K						
MTU, RD-358, \$125K					1	125K
MDU, RD-281/UYK, \$400K					1	400K
PCR, \$20K					1	20K
OCR, \$50K						
MMMVT, \$66K						
EMMVT, AN/USQ-69, \$16K					2	32K
MMMCT, \$89K						
VMMCT, SELECTRIC II, \$1K						
AN/USQ-69, EMMCT, TT-624(V)/UG, \$39K					8	312K
MMR, \$20K					1	20K
MRDIS, \$125K						
COST SUMMARIES						
BASIC SYSTEM HARDWARE						1977 K
SOFTWARE DEVELOPMENT AND DOCUMENTATION						3000K
SYSTEM DESIGN						*
SYSTEM ASSEMBLY						*
SYSTEM INTEGRATION AND TESTING						*
SYSTEM DOCUMENTATION						*
SYSTEM INSTALLATION						*
LIFE CYCLE SUPPORT		ĺ				*
HARDWARE AND SOFTWARE COSTS						4977K

^{*}Unknown

MESSAGE PREPARATION SYSTEM EVALUATION

The message preparation system rating criteria gave a basis for evaluating different system and media approaches. This section deals with analyzing each system and media approach with respect to those criteria. For ease of discussion, the performance levels of message preparation systems are discussed separately in the following paragraphs.

AMPS I Evaluation

An AMPS I would be suitable for a ship with low to moderate outgoing message requirements although it also could be used effectively on a large ship with heavy outgoing message loads. It would automate the preparation of ACP 126 (modified) format messages for transmission to NAVCOMPARS. It would have no ACP 126, ACP 127 or JANAP 128 capability, nor would it have magnetic storage for history or journal files. The message output would be either on paper tape or directly to a transmission system such as NAVMACS. Even at this capability level, it is expected to handle 80 to 90 percent of the outgoing message requirements of its target platform.

Of all the functions involved in generating, staffing and preparing an outgoing message for transmission, automation of the message preparation function provides the greatest improvement in communications center efficiency and the greatest decrease in writer-to-reader times. A drastic reduction in message preparation time and errors occurs when message parameter validation, formatting, tape cutting, proofreading and correcting are either automated or eliminated. Tape cutting (retyping of the message), proofreading and correcting are all redundant steps since these were also done before the message was delivered to the communications center. Another benefit of automatic message preparation is the reduction of personnel and skill level requirements within the communications center. Even with these reductions the communications center maintains the capability to handle a large increase in the number of outgoing messages with no increase and little or no backlog of messages. Operational data documenting the benefits of automatic message preparation are contained in References 1 and 3.

Performance/Cost

AMPS I, being a relatively moderate performance candidate, must have a correspondingly low cost to justify its use. In this case, the magnetic and electrical media based systems are at a severe disadvantage because they require expensive remotely located message preparation terminals. Page media using OCRs can be implemented using low cost electric typewriters. Performancewise, a major advantage of magnetic and electrical media based systems is their editing capability. But this capability is not cheap. With the addition of memory to an electric typewriter, the editing capability can be achieved for page media at a much lower cost than distributed display terminal or magnetic card/tape/disk terminals. A major advantage of networked smart terminals is their capability for speed-of-light delivery. Using one or two remote terminals for the composition and delivery of high precedence messages becomes cost effective for most ships if all review, approval and release functions are done at the composition terminal and if the terminal is located in secure spaces where only authorized personnel are permitted to view classified messages. Essentially, the remote terminal is just another means of inputting messages into AMPS which is located in the communications center. A remote terminal used in this manner provides the ship's commander with a near real-time message generation and delivery capability for record communications.

From the standpoint of basic cost, page media is the best choice for AMPS I. In conjunction with a single remotely located video message composition and entry terminal, it yields a high level of performance at a reasonable cost.

Impact

The impact of systems based on magnetic media upon the present message composition and preparation process would be significant. This mainly is due to the fact that the media are not readable by humans and require many reading terminals. These terminals must be documented and supported. Schools to train maintenance personnel would have to be developed, not only for the message preparation system, but also for the remote message composition and review stations. As discussed in the previous section, security procedures to deal with the storage and reuse of the magnetic media would have to be formulated and promulgated. The impact of these could be significant upon ships operations.

Magnetic, electrical and, to a lesser extent, page media would have a beneficial impact upon the data integrity problems of the present message process. This is due to the inherent machine readability of the media. No human translation is required to change the typewritten message into an electrical signal for broadcast over a radio or landline. Thus, whatever is typed is going to go out as is, with no chance of an inadvertent human error in preparing the message.

Page media would have the most beneficial impact upon operator training, as it require the simplest equipment suite and the least change in present communications center procedures. The main benefit here would be in the area of reduced need for paper tape preparers. For electrical and magnetic media, this would be offset largely by the operator and maintenance personnel and training required.

Ease of Development

As far as ease of development is concerned, none of the proposed capabilities of AMPS I would be a technical risk. The technology to implement them exists and is state-of-art. The OCR based system would be easier as it requires less basic hardware for a given performance level. A commercial OCR could have to be certified for shipboard use or militarized as none exists now. This is also a problem with respect to magnetic media as the present military inventory of service approved magnetic media units is limited and expensive.

AMPS II Evaluation

An AMPS II would be suitable for a medium to large ship with moderate to heavy outgoing message requirements in a variety of formats. It would handle narrative traffic in ACP 126, ACP 126 (modified), ACP 127 and JANAP 128 formats. In excess of 90 percent of the outgoing message requirements could be handled by this type of system with little or no manual intervention. The primary limitations on this level of system are that it does not handle data pattern traffic nor does it automatically handle messages requiring sectioning or segmenting. These can be handled semi-automatically using minimal manual intervention.

Performance/Cost

SMPD II is a relatively high performance system that can still yield a very high performance-to-cost ratio. As in the case with AMPS I, page media would be by far the least expensive media to use as the primary input. Magnetic and electrical media require expensive terminals outside of the communications center, putting them at a severe cost disadvantage. These media would be cost competitive if each terminal could be procured for \$5K or less. Considering the present cost of relatively unsophisticated militarized ADP equipment (e.g., AN/UYK-20 mini-computer, \$60K; AN USH-26 cartridge magnetic tape unit, \$23K; AN/USQ-69 keyboard video display, \$16K, etc.), it is highly unlikely that any sophisticated terminal could be procured for less than \$30K each. The cost could be as much as \$100K each. Page media require only the electric typewriters currently used on most ships.

Impact

The impact of this type of system would be much the same as for AMPS I. Beneficial impacts would include drastically reduced message preparation time and reduced personnel requirements. Page media would have the least negative impact as they require only a slight modification of existing procedures. Magnetic and electrical media would have a heavy impact as they require a revamping of existing procedures. As electrical and magnetic media require more hardware, their maintenance cost would be higher than page media. Security procedures to ensure no compromise of classified information would be much more difficult than for page media.

Ease of Development

Technology exists to implement an AMPS II. There are no significant areas that are stumbling blocks to fielding such a system. Electrical and magnetic media based systems would, however, require the development of a remote terminal or terminal multiplexer. Page media would require the militarization of an OCR for shipboard use.

AMPS III Evaluation

An AMPS III would be a high performance system suitable only for a large ship with heavy outgoing message requirements. It would handle all traffic that an AMPS II could handle, plus be able to handle data pattern traffic, pro forma message generation and automatically section or segment messages. In short, it would do everything but automate the backrouting, review and release functions. For all practical purposes, such a system could handle all of the expected outgoing traffic.

Performance/Cost

AMPS III would be a high performance, high cost system. Its ratio of performance/cost would not be as great as that of AMPS II, as it handles only an additional 10 percent of the message traffic, while its cost would be far greater than AMPS II. As one considers systems of higher and higher cost, the choice of media becomes less and less a significant factor. An extra \$200,000 added to a \$1,000,000 system is not nearly as great as \$200,000 added to a \$100,000 system. However, even for AMPS III, page media would still be less expensive on both an initial procurement and life cycle cost basis.

Impact

The impact of AMPS III would be much the same as AMPS II. Its beneficial impact would be slightly higher due to its greater capability. Its negative impact would be minimized by the use of page media instead of magnetic or electrical media.

Ease of Development

The technology exists for developing an AMPS III, but the task would not be an easy one. The processing power required would necessitate using an AN'UYK-7 computer or possibly networked AN/UYK-20 minicomputers. The task of developing the software to handle the sophisticated message processing requirements of an AMPS III would be a multimillion dollar and multiyear effort. Networking minicomputers would be less expensive with respect to hardware cost, but would complicate the required software, making it harder to develop.

AMPS IV Evaluation

An AMPS IV would have all the capability of an AMPS III plus automate the back-routing, review and release functions. This would be a highly capable system that essentially would automate totally the communications center outgoing message process. It would be practical only for large ship applications where its capabilities were felt to be essential.

Performance/Cost

Even taking into consideration the high performance capabilities of an AMPS IV, its cost would be correspondingly high and give it the lowest performance/cost ratio. The additional capabilities of this system over those of AMPS II or AMPS III are high cost items. At this stage the media essentially are electrical, although magnetic and page media could also be used. A system of this level of complexity would be much more reasonable if it were a subsystem of a much larger system that would control all facets of a ship's operations; in other words, a fully automated ship. As a stand-alone system it is too expensive.

Impact

The administrative and operational changes required by this level of system would be significant. Operator and maintenance personnel training would be most costly for this level. The security procedures necessary to ensure the integrity of classified data displayed at remote terminals would have a serious impact on normal day-to-day operations. Displays would have to be shielded electronically as well as from inadvertent visual disclosure. The message composition review terminals would be integral parts of the ship's operations and would require the officers to report to their terminals at designated intervals to clear out any pending messages. By their very nature, the terminals would be complicated to operate and would require the officers and entisted personnel to have extensive training to use them effectively. Also, due to the large amount of electronic equipment required for an AMPS IV, the lifecycle maintenance costs are hard to estimate, but would likely require several maintenance technicians.

Ease of Development

An AMPS IV, with its very sophisticated capabilities, would be moderately risky to develop. The ramifications of the use of this type of system are widespread and affect many

facets of ships operations. A great deal of system development time and money would have to be spent on the quality assurance of such a system to ensure that it would work as advertized and be accepted by the operational community as an asset rather than a liability. Far too often, systems have been touted as the "greatest thing since steam and cheap too," only to be found to fall far short of goals and requirements by the time they reach the OPEVAL stage.

CONCLUSIONS AND RECOMMENDATIONS

Automating or semi-automating the message composition and preparation process is not simple. In this age of limited budgets, the Navy must concentrate on maintaining a lean, effective fighting force on a minimal amount of money. Cost effectiveness is more important now than ever, and any high cost system comes under very close scrutiny, irrespective of its performance capabilities. In this atmosphere it is not possible to recommend the development of either an AMPS III or AMPS IV. The cost is too high and the relative improvement over an AMPS II is marginal at best. The Navy would be better off to push for the development of a relatively inexpensive AMPS II or AMPS I that would yield a significant increase in capability over the present manual system at a relatively modest cost.

Among the media choices available, page media in conjunction with an OCR is clearly the most reasonable choice based on its low cost alone. The fact that it also causes minimal impact upon the present manual system, while still allowing the automation of the most time and personnel-consuming functions of the typical ship's communications center, makes it a clear favorite. OCR technology is now at the stage where page media can seriously challenge magnetic media in the domain of machine readability, and greatly improve the present system based on reading by humans. This is done without reducing the information to a form that is unreadable by the human eye.

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APPENDIX A

OPTICAL CHARACTER READER (OCR) CHARACTERISTICS
AND EQUIPMENTS

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Character delete		INA INA
Character delete		
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Page reject Yes Yes INA Yes INA IN		
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34. Error 35. Power on INA	Ι'	
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37. Automatic reder and capacity Reject hopper available and stack capacity Output stacker capacity Page recovery during jam conditions 41. Transfer Rates Available 600 or 1200 baud Automatic reder and capacity Pes, 50 sheets Yes, 50 pages Yes, 50 pag		
Reject hopper available and stack capacity Quitput stacker capacity Quitput stacker capacity Page recovery during jam conditions 41. Transfer Rates Available 600 or 1200 baud 240 and 4800 bits second 741. Transfer Rates Available 600 or 1200 baud 742. Transfer Rates Available 600 or 1200 baud 743. Specialer than 50 INA	,	Yes 50 pages
39. Understack capacity 40. Page recovery during jam conditions 41. Transmission Interfaces Available 42. Transfer Rates Available 43. Transfer Rates Available 44. Transfer Rates Available 45. On 1200 baud 46. Page recovery during jam conditions 47. Transfer Rates Available 48. Understanding the state of the state o		INA
39. Output stacker capacity Page recovery during jam conditions 41. Transfer Rates Available RS-232-C EIA RS-232-C EIA RS-232-C MIL-STD-188: up to 3 asynchronous or synchronous; up to 3 parallel 42. Transfer Rates Available 600 or 1200 baud 2400 and 4800 bits second 75 to 9600 baud asynchronous up to 64 kilobits/sec isochronous 1NA		
40. Page recovery during jam conditions Yes ENA INA 41. Transmission Interfaces Available RS-232 C EIA RS-232 C; MIL-STD-188-100 MIL-STD-188-100 WIL STD-188: up to 3 asynchronous or synchronous; up to 3 parallel 42. Transfer Rates Available 600 or 1200 baud 2400 and 4800 bits second 75 to 9600 baud asynchronous up to 84 kilobits/sec isochronous 110 to 9600 baud	11	INA
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42. Transfer Rates Available 600 or 1200 baud 2400 and 4800 bits second 75 to 9600 baud asynchronous up to 64 kilobits/sec isochronous 110 to 9600 baud	11	IN A
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43. Self Test Mode INA INA INA		INA
NAVSEM 5100 NAVSEM 5100 MIL STD 461A NAVSEM 5100	D 188 100	NA
Physical Dimensions		
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46. Work (overall) 31" 28" 28" 47, Height (overall) 45%" 28"	27	

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! †	LCS Eorporation	Context Corporation	Context Corporation	Cantrol Data Corporat	Cummins A . Cirporation	Dest Date projet in	Menc .
! +	Cumpu Text Scanner	Model 201	Mode: 218	92650	4225 11	OCH WORD	Tuge edi
H00	S25 000 Video typing station \$5.760 Exectronic typing station \$7.680	Approximately \$15 000	Approximatel, \$15,000	App.: x mater, \$25,000	 \$30 e00	INA	\ <u>^</u>
	op is 228 Three to right	Up to 400 INA	400	1 684 Three 's fig.	1944 5	200 400 pt 16 6 19 to 3 15 that a text to 3 10 pt 16	up 1 220
	CCRR	OCRB	OCR B	0CH 4 0CR 8	OCA B		, mesa cossis
	indernational distance for our	85 standard 96 or 120 optional	86	58	īNA	. 88	CONTRACTOR
•	(NA		1NA 1 -> 10 000 - hearth 1 -> 15 000 - hearth 10 25 001 - hing - th 0 05 - section	March Marching Lin 10 000 Lin 10 0000 Lin 10 000 Lin 10	INA INA INA INA INA INA INA	15% A 1 or 10 002 harming. 1 or 100 072 grants. 10 25 carab. 1% A	1 (NA) (NA) 1 2 2 350) NA - NA
	ıΛιΑ	INA INA	LINA INA	0.1 some at 0.14 months	INA INA	Lina	NA NA
	right red and right brue	INA	red or brue	red	INA	red is a control to its order.	
	5 x 5 up to 12 X 12 INA	8 1X 111 m 14	8 X 11 up to 14 INA INA Sides top and hattom INA	8 X 10 8 X 11 20 m 24 ib 1952 0.5 top and left; 0.25' bottom 0.3 right	INA INA INA INA	point 1944 18 both of the k PAR Hermonded Code Code, top and both	5 X 5 P 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1	r v a	,	,		INA	75	paper width in
l f	INA INA	up to 5	up to 5	1 1 up to 6	INA 3 ur 4 INA) 5 6 ΙΝΔ	paper width in 1 line 2 in 3 line at ter per
	INA	INA INA	0.1 Tatung tine	18	INA	INA	character per
	INA	INA	INA	32	INA	INA	INA
	INA INA INA	YPS YPS INA	Yes Yes INA	Yes Yes Yuc	INA INA INA	Yes Yes INA	Yes Yes IVA
	INA	INA	INA	No No Yes No Yes	INA INA INA INA	INA INA INA INA	INA INA INA INA
	Yes, 50 pages	Yes	Yes, 50 pages	Yes, up to 50 pages	i No	Yes, 200 pages	Yes, 50 pages
,	Yes, 50 pages INA	ina	Yes, 50 pages INA	Yes, up to 50 pages Yes, -/" stack	INA	Yes, 200 pages	Yes, 50 pages
	INA	INA	INA	%" stack	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA
	INA	RS-232, parallel or serial data	ASCII 8 bit parallel ASCII 8 bit serial 2741 IBM 6 bits and parity	RS 232	INA	RS-232 current loop -20 or 60 ma -	RS 232 2741 cutrent loop
	INA	up to 9600 baud	110 to 9600 baud (serral) 113.6 to 9600 baud (2741 IBM)	600-38, 400 baud synchronous >5 to 9600 baud asynchronous	INA	110 to 9600 band asynchronous	75 to 9600 band
	INA	INA	INA	Yes	INA	INA	INA
88-100	INA	INA	INA	INA	INA	INA	INA
	27" 38"	19%" 30"	19%" 30"	23" 41"	INA	29" 27"	27" 39"

	•		_				•
<u> </u>	11	12	13	14	15	16	
	Hendrix	International Business Machines (IBM)	Optical Business Machines	Scan Data Corporation	Scan Optics Incorporated	Scan Optics Incorporated	Systematics
		-		<u> </u>			
	Typermader	3886	Laser OCR ONE	2250 1 OCR System	515 Svitem	System 540 Model (II)	SGC 15132
•	INA	INA	INA	\$288 000 :475 recognition unit: Multifont capability	\$50,400 up to \$80,700 Document serializer, microfilming module	\$200 000 to \$250 000	/ % .a
ine	Up to 220 Three to four	155 4.1	320+8 X 11 page 8 8 (8 , X 11 page	400 up to 1600 optional INA	Up to 250	INA i50 min. for 30 lines 460 characters each	% A
i	DCR A OCH B	OCR A OCR B 3 16 Guthic	OCR A OCR B Handprin:	OCR A or OCR B	OCR A OCR B 3 16 Gothic	OCR A OCH 8 1403 407 1	1 .NA
1	OCR B including International character set	de	56	Upper and lower case and numerics	Alphanumerics plus special characters	Aiphanumeric 3.16 Gothic	**************************************
i	INA	INA	Matrix Match	Frature analysis	Feature analysis	Feature analysis	:NA
	1 m 20 000	INA INA	INA INA	INA INA	INA INA	1%A	-NA
	INA	INA	8 9 or 10	10 or 12	10	10 In A	NA NA
	INA	78	80	INA	80	up to 85	- MA - AA
	INA	INA	0.75' character height: 3 line inchi 0.1' character height: 6 line inchi	INA	INA	INA	NA.
)	INA	INA	3 from vertical	INA	INA	INA	IN A
)	INA	INA	1.6 minimum	INA	INA	INA	NA
	INA	INA	INA	INA	INA	INA	iNA.
Всягво	light red. light blue	INA	INA	INA	INA	INA	INA
, ,	5" X 5 - up to 12" X 12" INA	3" X 3" to 9 ' X 12"	2 9 ° X 3 25° up to 8 5 - X 13 5	5" X 3 - up to 11 - X 14	2' X 2 + up to 9 X 14	4 ' X 3 up to 9' X 14'	(NA
	INA	INA	15 to 36 fbs 90 to 100 fbs 0 003 to 0 008	15 to 32 tbs.	16 to 100 ths	INA	INA
Les top	Too sides. It on top and bottom	0.542" tup, 0.3" right, 0.5" left,	0.17" top and bottom (0.25" left	INA	INA	INA	INA
)	INA	0.25" bottom	0.15" right greater than 80 - at red light wavelength.	INA	INA	INA	15 A
-							1
ı	paper width minus 1	7.7° (8. " wide paper;	8 1" 3 or 6	INA	8	8	INA
,	1 or 2 or 3 character per line	3 INA	1.6 maximum for 3 line inch 1.2 maximum for 6 line inch	INA	up to 6 INA	up to 6 INA	INA
	INA	INA	INA	INA			INA
<u></u>	INA	29	up to 78 max for 8 / 1 X 11" 30 typical for 8 / 1 X 11"	INA	INA INA	INA INA	INA INA
)	:						!
	Yes Yes	Yec	Yes Yes	INA	INA	INA INA	INA INA
'	INA	Yes Yes	Yes	Yes	INA	INA	INA
							+ !
	INA	Yes	INA	INA	INA	INA	INA.
	INA	Yes	INA	INA	INA	INA	Yes
	INA	Yes	INA	INA INA	INA INA	INA	(NA
	INA INA	No Yes	INA	INA	INA	INA INA	Yes
							1
	Yes, 50 pages	Yes, 1" stack, 4" stack optional	Yes, 4" stack	Yes, 6" stack	Yes	Yes	Yes - 1 - 15
	INA	Yes, 1" stack, 4" stack optional	Yes, 4" stack	Yes, 6" stack	INA	INA	1
	INA	1" stack, 4" stack optional	2" stack	6" stack	INA		INA
	INA	Yes	INA	INA	INA	INA INA	Yes
	RS 232	INA	INA	INA	INA	INA	MIL STO 1
	2741						
ľ	current loop		1				
 —→							
lous	75 to 9600 band including 134.5	INA	INA	1200 to 9600 baud	INA	up to 9600 synchronous	up ta 960(
	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	WIL STO 18
					ngel	INF	172 310 10
	27"	70"	32½" An::	INA	45"	34"	INA

14	15	16	17	18	19
Scan Data Corporation	Scan Optics Incorporated	Scan-Optics, Incorporated	Systematics General Corporation	Vydec Incorporated	Recognition Equipment Inc. (REI) Dallas Texas
2250 1 OCA System	515 System	System 540 Model III	SGC T5102	Model 0760 01	input 80 Model C1
\$288,000 (475 recognition unit) Multifort capability	\$50,400 up to \$80,700 Document serializer, microfilming module	\$200,000 to \$250,000	INA	INA	\$200,000 includes magnetic tape mini- computer CRT console and printer
400 up to 1600 optional INA	Up to 250	INA (50 min for 30 lines, 460 characters each)	INA INA	INA INA	INA 55 (8191 X 1111)
OCR A or OCR B	OCR A OCR B 3 16" Gothic	OCR A OCR B 1403 407 1 Alphanumeric, 3 16" Gothic	INA	OCR 8	INA
Upper and lower case and numerics	Alphanumerics plus special characters	INA	INA	INA	64
Frature analysis INA INA	Feature analysis INA INA	Feature analysis INA INA	INA INA INA	INA INA INA	Matrix Matching INA INA
10 or 12 CINA	10 80	10 up to 85	INA INA	, 10 INA	7 to 12
INA	INA	INA	INA	INA	INA
INA INA INA	INA INA INA	INA INA	INA INA INA	INA INA INA	INA INA INA
: _ !NA	I INA	INA	INA	INA	INA
5 1 X 3 11 op to 11 - X 14 - 15 to 32 (b).	2 X 2 2 up to 9 X 14 16 to 100 lbs	4 ' X 3" up to 9" X 14"	INA INA	81:11 X 1111 1NA	2 9" X 2 75" up to 12" X 14 INA
INA	INA INA	INA I INA	INA	INA 1" top and bottom, ">" sides	INA
F [INA	INA	INA	INA	INA	INA INA
INA	8" up to 6	8 " upto 6	INA INA	INA 1½, 2 or 3	INA up to 4
INA	INA	INA	INA	INA	INA
IVA	INA INA	INA INA	INA INA	INA INA	INA
IN A	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA Yes
Yes	INA	INA	INA	INA	1.65
INA	INA	INA	INA	INA	INA
INA INA	INA INA	INA	Yes INA	INA INA	INA INA
INA	INA	INA	INA	INA	INA
INA	INA	INA	Yes	INA	INA
Yes, 6" stack	Yes	Yes	Yes, 'a'' stack	Yes, 50 page stack	Yes
Yes, 6" stack	INA	INA	INA	INA	Yes
6" stack	INA	INA	INA	INA	INA
INA	INA	INA	Yes 100 100	INA	INA
INA	INA	INA	MIL STD-188-100	INA	INA
1200 to 9600 baud	INA	up to 9600 synchronous	up to 9600 baud	INA	up to 9600 baud
INA	INA	INA	INA	INA	INA
INA	INA	INA	MIL STO 188 C NAVSEM 5100 MIL STO 188 100	INA	INA
INA	45"			27"	
_ i_ INA	17.	34" 91"	INA INA	39"	INA INA

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	ralet separar		# P7	`` !		
18	Drap 6.1 71	Red and blue	OCR on head red and brus	(NA	· ·	
-	Page input					•
19	Page size	8 x 10 '	up to 81 x 14	8 x 10		
20	Paper weight	20 lb to card stock	12 ib to card stock	:%A	5.5	·.
21	Paper thick essi	0.003 to 0.007	INA	1%A	% A	٠,
22	Margins	ail sides	about 1-16	184	A Committee of the Comm	٠.
23	Reflectivity	70° minimum	INA	INA	4:	
"		78 ; 111111111111			4 1	• '
24	Maximum ine length	7.6"	838	iNA	\	,
25	Line pich	up to 6	5 or 6 3 if double spaced	·	in the state of th	
26	Line show	0.03 per inch	one Character height per line length		INA	i.
27	Line missienment	1				
28	Line missignment Lines per page	- 0 027" up to 20	INA up to 50		N= 24	•
<u> </u>	Circa par page	up 10 20	up to 30			
Į I	Edit Features	l				
29.	Character delete	Yes	INA	Yes	• •	•
30	Line delete	No	INA	Tes	•	•
31	Programmable scanning	Yes requires complete program change:	Yes	15 A	• •	``
		 				•
	Status Indicators)		IA,A		
32	Page rejec	Yes	Yes		•	٠,
31 34	Jamming detection Error	Yes Yes	INA No		- 6 - \ Λ	
35	Power ava able	INA	INA		N.a.	
36.	Power on	INA	Yes		in et a	
\vdash	Mechanical Input, Output and Trans-					
]]	fer of Page			INA .		
37	Automatic feeder and capacity	Yes, 50 sheets	Yes, 50 pages		Ye, 50 pap -	• •
38	Reject hopper available and	Yes, 50 sheets	Yes, greater than 50		Yes	N. 1
1 1	stack capacity		-			. N. A
39.	Output stacker capacity	50 sheets	greater than 50		154	
40	Page recovery during jam con- ditions	Yes	INA		1/4.4	NA
41	Transmission Interfaces Available	RS-232-C	EIA RS-232C	MIL STO 188 100	Mil STD 188 100	,
		1.0 1.51 0	MIL STD 188	1		
1 1			up to 3 asynchronous or synchronous.	!		
			up to 3 parallel	į		
 	* 4.5. 4.			75 to 9600 baud asynchronous up to	4-1	100
42	Transfer Rates Available	600 or 1200 baud	2400 and 4800 bits second	64 kilobits sec isochronous	110 t., 9600 basd	. 134-4
-						
43	Self Test Mode	INA	INA	INA	INA	15.4
\Box				<u> </u>		
44	Military Specification Conformance	MIL STD 188C	MIL STD 188C	MIL STO 188 100	MIL STO 188 C - MIL STO 188 100	
		NAVSEM 5100	NAVSEM 5100		MIL STO 4614	1844
┝╌┥	Physical Dimensions		<u> </u>		NAVSEM 5100	
45.	Gepth (overall)	56½"	30"	28	INA	1 2 ?
46.	Width (overall)	31"	26"	28		39
47	Height (overall)	45½"	24"	INA		40"
42	Weight	465 lbs. (includes other than OCR)	100 lbs.	INA		300 162
1 1	Power Required				111,1116	
49	Voltage (AC)	105 to 125 Volts AC	120 VAC	115 VAC + 23 VAC or 238 VAC - 48 VAC 7.5 Amps @ 115 VAC Starting	115 VAC 7 5 to 10 Amperes	115 V 10 An peres
50.	Current	9 Amperes	10 Amperes	5.0 Amps @ 230 VAC Starting	. O to to marpers	TO AT DETES
51.	Frequency Phases	60 Hertz	47 to 63 Hertz	50 + 2.5 Hertz or 60 + 3 Hertz	60 Hertz	60 Hertz
52. 53.	rnases Watts	INA 1035	INA	Single	Single	INA
╙		1033	INA	460	INA	INA
	Environmental					ļ
54	Operating ambient temperature	40° 1- 00°5	C. 40:0	40, 41, 20, 2	10' to 32 C	10 10 40 C
55.	humidity (non-condensing)	40° to 90°F 10 to 90%	5" to 40" C	10" to 26 C 95% @ 25 C	20 to 95%	INA
56. 57.	Storege and shipping	10 10 30%	5 to 95%	33% @ 23 L		
SA	ambient temperature	INA	INA	~ 20" to + 71"C	- 20° to + 71 C	INA
144	humidity (non-condensing)		INA	INA	INA	INA
80.	altutude	INA	INA	10,000 feet	10,000 feet	INA
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INA - Information Not Available

N/A = Not Applicable



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	INA	INA	(%A	INA	I NA	**	5.5
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1	INA	Yes	Yer	1 10	(NA		• •
	INA	Y+ 5	Yes	Y .	INA INA	'' \hat{h}	٠, :
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	INA	INA	INA	No.	1NA	NA.	.
	rue -	1	•**	N ·	ł N A	-N-4	*. 4
		}		Yes	INA	NA	V.A
		1		No.	INA	154	NA.
		<u> </u>		Yes	INA	i\A	- \ \ \
	V 10	1	Yes 50 pages	Yes up to 50 pages	No	New 230	• .
1	Yes 50 pages	Yes				1	
	INA	INA	INA	Yes, stack	INA	1%4	
	INA	INA	INA	₄‴ stack	INA	INA	15,4
	INA	INA	INA	INA	INA	INA	$\{ Y_i A$
	INA	 ```		 	+	 	
	INA	RS 232, parallel or serial data	ASCII 8 bit parallel	RS 232	INA	RS 232	#5.2 - : 2141
		(ASCII 8 bit serial	ļ		- 13 60 tu	
			2741 IBM 6 bits and parity	1			
				·		1	
	INA	up to 9600 baud	110 to 9600 baud (serial)	600-38, 400 band synchronous	INA	110 % 9600 band asynchronous	75 :
			113.6 to 9600 baud (2741 IBM)	5 to 9600 band asynchronous			1
	INA	INA	ina	Yes	INA	INA	15.4
	, man	(TEA	in w		\		,
	 				+		-
88 100	1					1	
	INA	INA	INA	INA	INA	INA	INA
	†				1	1	27
	21"	1917"	1977	23	INA	29	39
	39	30"	30"	41"	Í	40	40
	40"	371.7	37'2"	39"		270 16	300
	300 lbs	160 (bs.	160 lbs.	400 lbs.		1	+-
	115 V	115 V	115 V	100 to 120 100, 200, 220, 230, 240, 250	INA	115 VAC 220 VAC	115
	10 Amperes	4 Amperes	4 Amperes			16 Amous. 7 6 Amous.	10
	, ·	\		10 Ameres 5 to 10 Amperes	k	15 Amperes 7 5 Amperes 60 Hertz 50 Hertz	60
	60 Hertz	50 or 60 Mertz	60 Hertz INA	60 Hertz 50 Hertz Single Single		INA INA	IN.
	1	INA	INA	INA INA	<u> </u>	INA	IN.
	INA						
	1			ė .		1	1
	INA			İ		1	1
	INA	10° to 35°C	10 to 35°C	50 to 95 F	INA	0 to 40 C	- 1
	INA INA		10 to 35 C 20 to 80%	50° to 95 F 20 to 80%	INA	0 to 40 C 10 to 90°:	- 1
	INA INA 10° to 40° C INA	10" to 35"C 20 to 80%	20 to 80%	20 to 80%	INA	10 το 90":	30
	INA INA 10° to 40°C INA	10" to 35"C 20 to 80%	20 to 80%	20 to 80°•	INA	10 to 90°:	30 IN
	INA INA 10° to 40° C INA	10" to 35"C 20 to 80%	20 to 80%	20 to 80%	INA	10 το 90":	10 30 IN/



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tan ili artin	igh*red right5+	iNA	INA	_:NA	1/4	- (NA
		1				
	5 x 5p /u 12 X 12	3 x 3 1e 9 x 12	29 x 325 april 85 x 135	15 x 3 /g = 11 x 14	7 × 2 + up 1 9 × 18	4 x 3 up to 9 x 14
	INA	INA	15 to 36 to 90 t 100 by	15 to 32 bs	16 to 100 (6)	194
	INA	INA	0 003 % 0 008	IN A	rs a	ⁱⁱ i%A
modes to an top	Tunisines, 1 include and buttom	0.542" trip, 0.3 right 0.5 left	0.17 top and portion 0.25 left	INA	1% A	(NA
" 104; 1 9 top	The state of the s	0.25 bottom	G 15 right			+ 1 % A
	INA	INA	greater than 80 - at red contissasemingt	INA	INA	
	paper width minus 1	7.7 :8 wide paper:	8 1 3 or 6	i ∧ A	c	В
	1 or 2 or 3	3	1.6 maximum for 3 line is n	I%Δ	Lup 1. b	_j ./p * ∞ 6
	character per line	INA	1.2 maximum for 6 line inch	1%A	IN-A	INA
	1		INA	INA	i N A	INA
	INA INA	INA	up to 78 max for 8 X 11	INA	15A 15A	INA
	INA	29	30 typical for 8 " X 11"	+		
			:		1	INA
	Yes	Yes	Yes	INA	IN A	INA
	Yes	Yes	Yes	INA.	: PNA	INA
	INA	Yes	Yes	Ye,	·NA	
	 					1
				LINA	. INA	INA
	INA	Yes	INA	INA	INA	INA
	INA	Y+-	INA INA	INA	IN A	INA
	INA	Ye ₂	FNA	INA	1% 2	INA
	INA	No	INA INA	INA	INA	INA
	INA	Yes	1 VM			
	Į.					
	Yes, 50 pages	Yes 1' stack 4' stack optional	- Yes 4 stack	Yes 6 stack	Yes	Yes
					1818	1810
	INA	Yes, 1 stack, 4" stack optional	Yes 4 stack	Yes, 6' stac*	INA	INA
	INA	1" stack 4" stack optional	2 -tack	6" stack	INA	INA
	INA	Yes	INA	INA	INA	INA
				-i		INA
	RS 232	INA	INA	15y A	INA	INA
- till + y	2741				ļ.	ļ
	current loop				F	1
	 	 	 	+		
es, achtanous	75 to 9600 band including 134 5	INA	INA	1200 to 9600 band	INA	up to 9600 synchronous
						
	INA	INA	INA	INA	INA	INA
	 					
	INA	INA	INA	INA	INA	INA
	100	INA	INA		1112	<u> </u>
	27"	1.00	32"."	INA	45"	34"
	39"	70"	48"	INA	12"	91"
	40"	60	66"."	INA	46"	74"
	300 lbs	1500 lbs.	1100 lbs.	INA	INA	INA
	 		+			
O VAC	115 VAC 220 VAC	208 or 230	117 VAC	INA	250 V	208 VAC
		INA	14 Amperes	INA	20 Amperes	25 Amps phase
5 Amperes	10 Amperes 5 Amperes	INA	60 Hertz	INA	50 or 60 Hertz	50 cn u
Hertz	60 Hertz 50 Hertz	3 Phases	Single	INA	Single	50 or 60 Hertz 3 phases
A	INA INA	INA	INA	INA	3.08 Kilowatts	J phases INA
	INA					UIA
	10 to 40 C	INA	60 to 95 F	INA	10 to 35 C	CC 70 F
	30 to 80°.	1	40 to 70%	INA	20 to 80°.	65 to 78 F
	20 10 90.0		70 (0 / 0.0	INA	20 (0 00 0	40 to 60°s
	INA	INA	INA	INA	INA	100
	100 A		INA	INA	INA	INA
		I INA				
	INA	INA	0 to 7500 feet	INA	INA	INA

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			(4)	•	1 45
				l N , ∆	INA
<u> </u>	<u>+ 44</u>	 	-+		132
			1		
5 43 95 11 4 14	2 822 45 3 4 4	4 x j pt 9 x 14	-NA	8 / x 11	29 X 275 up to 12 X 14
*5 * - 32 B -	16 1 138 h.	NA.	1 -NA	INA	INA
1 INA	INA	\ 4	INA	INA	i N A
-74	(% A	V A	1 NA	1 top and bottom sides	INA
NA.	i % A	-NA	-84	INA	INA
					
			NA NA	INA	INA
% A % A	d .	in the second se	INA	115 2 of 3	up to 4
NA	ε 1 - 6 (Ν Δ	A.A.	, INA	INA	INA
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1.4	MA	NA	INA	INA INA	IN A
NA	*\A		INA	ТУМ	177
			ì		INA
*. 4	184	*, 4	i _{IN} A	INA	INA
•, ::	\ A	% A	INA	INA	Yes
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NA NA	NA.	NA (NA	Yes	INA	INA
- '''		/44	Tes		
Vir. 6 Sarw	¥	Yes	Yes a stack	Yes 50 page stack	Yes
** g .gr.*			113	Į.	
Yes bustace	I % A	" INA	INA	INA	Yes
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b tac⊭ 'NA	INA	I∿A I∿A	INA Yes	INA	INA
·				ļ	INA
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1200 to 9600 haud				1	I un in 4600 David
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i\A	INA	up to 9600 systehroopers	up 1/- 9600 baud	INA	INA
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IVA	·		INA	INA	INA
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APPENDIX A OPTICAL CHARACTER READER (OCR) CHARACTERISTICS AND EQUIPMENTS 67/68

APPENDIX B
KEYBOARD DISPLAY TERMINAL (KDT) CHARACTERISTICS
AND EQUIPMENTS

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i ei	Reyboard Typeser-ton keyped	No.	78	No	٧.	 Y =	· **	Y=	٧
,	Busens terped	Tax 14 boys	te .	Y 106	Yes, 11 keys	Yes, 18 keys	Yes, 18 Key		No.
	Cursir control keypad General purposa fusction keys user defined	Yes & Seys	***	TOI INA	**	'm	INA Yes	Y== Y==	'm
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19	Num glare screen Character set	18tA 128 deployable ASCII	194.A	*# 64	(NA 128	INA 	· INA : Up to 128	. IRA Upper lower and son standard	INA ASCII 84 subset
1		11 special graphic symbols	ASEIT encoded	ASCII				!	Optional 128
76 21	Tah garana Sauran saran	%• %•	No.	No.	No.	i ka No	na No	No.	No No
22	Programmable brightness	IMA	19(A		T seeq	Ym	Yes	INA	INA
23	ilja of levels Nomber of leven	24	25	. 24	25	, T urb 25	Tems 25	24	25
25	Characters per line	·	H	60	60		80	80	
25 27	Reverse video (programmable)	Yes.	- INA INA	Yes Yes	Yes Yes	Yes Yes	Yes	INA V	INA Ya
27	Blocking (programmable) Serven serv	Yes 12 despondi	19-A 12 despansi	Yes 15 diagonal	Yes 12 diagonal	Yes 12' diagonal or 15' diagonal	7 x 6	Y == 11	12 diagonal
	Box-deploy field for security	INA	JINA	INA	INA	INA	Ym	INA	Programmable
31	Color display capability Corest	No.	None	No	None	None	Nene	Optional	40
32	control (key program or both)	beth	Key	Key	Key and program	Key and program	Program	Key and program	Program and key
ນ	type (blonking, underline reverse video etc.)	IRA	INA	Blimking	INA	Blinking, understore	Blinking or reverse video	i fin A	Birnking
м	addressable	Yes	in a	Yes	Yes		Yes	Yes	Ym
36	Der Metrix for characters (8 X 18, 18 X 15, etc.)	Yes, 8 X 8	INA	INA	7 X E	5 X 7	5 x 7	5 X 7	5 x 7
30	Status desplays (lights or line on CRT)	Yas, 25th line on CRT	INA	INA	Y-	INA	Z5th line on CRT	INA	26th line on CRT
37 38	Fig.bar free rafreds screen data rate	60 frames per second	INA	INA	50-50 Hertz	58 Hertz	INA	(NA	50 or 60 Hertz
30	phosphor type (e.g., P-4)	INA	INA	INA	INA	INA	INA	INA	' P4
44	Memory sate for deploy	24 issue by 86 characters	INA	80 characters X 25 lines	Two pages 50 lines X 80 characters	INA	2000 to 4880 characters	INA	2000 characters 11 page - edictional 2000 characters up to
H	Company and Edit Features	·	 						•·- · -
41	Erage to and of line Erage to and of page	Yes Yes	IRA IRA	INA INA	INA INA	INA INA	Yes Yes	INA INA	Yes Yes
43	Character deleta	Optional	! Yes	INA	Yes	INA	Yes	IRA	Ym
44	Line delete					100			
		Optional	INA	INA	Yes	INA	Yes	INA	Yes
45	Chair strees Character evenuests	INA	INA	:NA		INA INA			
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35	Dut Matrix for characters		INA	' INA	13.8	5 2 7	5 1 7	5 1 7) I '
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36	Status deploys (lights or line on CRT) Fischer free	Yes 25th have en CRT	IRA	194	***	- 4 A	Tate and the Fact		
38	region from refront screen data rate	60 traines per second	* INA	:N.A.	50 \$0 Hert:	60 Her']	/AA	1 4 A	540 × 60 ∞
38	phosphor type ie g . P.4.	INA	INA	INA	INA	INA.	INA	INA	P 4
44	Momeny size for display	24 inner by \$6 characters	IRA	80 characters \$ 25 inner	Total pages 150 into 1	:44	2906 to 4688 characters	1 % A	7905 that a
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41	Ergy to end of page	Yes Yes	INA INA	19.6 19.6	184 184	184. 184.	Yes	INA	Yes
40	Character delete	Cational	Yes	thA.		INA	Ym	IN A	**
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54	Forugard tab	Yes	INA	IRA	190	749	Yes	INA	**
51	Backmard tab	Yes	· INA	INA	TM.	Yes	Tm.	INA	Y PE
9.7	Adjust space and line automatically	INA	INA	IN A	(NA	ARI	Yes	14g A	I No A
1 1	unten characturs, words, or untencas are added or deleted		I						
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53	Automatically change paging when additions or deletions are made	'NA	INA	INA	I St A	. INA	Yes	INA	-NA
(54	Clear unprotected data	-NA	, INA	INA	I N ∆	IA A	Programmable	INA	Yes
156	Scraff up or down	INA	INA	INA	Us or down	IN A	Up at down	INA	Programma
56	Audible starm for and of line	INA	INA	HAA	Yes	T as	Tes	INA	INA
57	Audible plans for and at page	INA	INA	INA	IN A		i tn	INA	INA
58	Automatic paping	No	INA INA	INA	IN A	ily A	Yes	IN A	14 △
54 54	Pracacted fields (programmable) Curser control from keyboard	Ym Ym	Yes	INA Yes	Yn Yn	INA Yes	. Ym	(NA	Ym INA
61	Line number deplay	INA	INA	INA	INA	INA	Yes INA	Yes INA	INA
6.2	Column number desptay	INA	INA	INA	INA	INA	- INA	INA	INA
63	Word search for delete or replace	INA	INA	INA	i N A	IN A	Yes	INA	IN A
-	Rest page	40	INA	INA	Yes	INA	Programmable	INA	19 A
65	Provious page	Na	INA	INA	INA	I INA	Programmable	INA	I R A
86	First page Communication Interface and Control	No	INA	INA	. INA	. INA	+ Programmable	. IAA	, INA
62	Type interface	EIA RS 232 C CCITT V 24	INA	AS-232 (Date	AS 232C	RS 232C Current was	Asynchronous 2 were direct	9S 232	RS 232
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les!		75 av. 16 3W Box (DC 333 C)		114 9499 0					
4	Transmission rates	75 to 19 2K Bps (RS-232-C) 75 to 9600 Bps (current loop)		116 9600 Baud rates	Serectable up to 19 200 bps	Up to 19 2K Baud	Up to 9600 8ps were	asynchi anous	118 rhrough 9 mentchable
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64 50 70	Trangmesson rates Trangmesson modes character at a time	25 to 9600 Bps (current leap) All rates are switch selectable 12 rates evoluble		110 9600 Baud rates		Up to 19 2K Baud		asynchranous Up to \$35 Boud asynchranous	118 rhrough 9
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	INA INA INA INA INA INA INA INA INA INA	INA INA Up to 9500 Bps INA INA INA INA INA INA INA INA INA IN	70 ma current some HS 212 C	MS TOT TENT TOWN TO THE TOWN TO THE TENT TOWN TOWN TOWN TOWN TOWN TOWN TOWN TO	18.4 RS 222 C CCS117 9000 Basel suprichessors, ever 29.000 Basel suprichessors, ever 19.000 Basel suprichessors in A IRA IRA IRA IRA IRA IRA IRA IRA IRA I	18A RS 732 78 ma content top 75 118 300 500 1200 2400 4800 9600 Baud 18A 18A 18A 18A 18A 18A 18A 18A 18A 18A	E1A 20 ha sphones Ue to 19 296 Eased RA 18A 18A 18A 18A 18A 18A 18A 18A 18A 18	No PS 732 C Up to \$500 Baild synchronous or provide enous MA MA HA HA HA HA HA HA HA HA HA HA HA HA HA	RS 232 C 20 int current one 50 through 19 700 8ps in 19 tres 15A 15A 15A 15A 15A 15A 15A 15
	INA INA INA INA INA INA INA INA INA INA	INA INA Up to 9600 Bps INA INA INA INA INA INA INA INA INA IN	10 11 12 13 14 15 16 16 16 16 16 16 16	INA INA INA INA INA INA INA INA INA INA	18.1 2" 19.1 2" 19.1 2" 19.1 2" 19.1 2" 19.1 2" 19.1 2" 19.1 2" 19.1 2" 19.1 2" 19.1 12" 19.1 12" 19.1 14.1 14.1 14.1 14.1 14.1 14.1 14.1	18 A RS 727 This real constant loop 75 118 300 500 1700 7400 4800 9600 Beard IN A IN A IN A IN A IN A IN A IN A IN A	E1A 20 no serionne Up to 19 206 Eased MA /MA INA INA INA INA INA INA INA INA INA IN	No PS 722 C Up to \$500 Baild synchronisks or consists on consists	RS 232 C 20 ms conventions So through 19 700 flox in 19 tres 19 700 flox in 19 tres 19 700 flox in 19 tres 19 700 flox in 19 7
	INA INA INA INA INA INA INA INA INA INA	INA INA Up to 9600 Bps INA INA INA INA INA INA INA INA INA IN	70 ma current some HS 212 C	MS TOT TENT TOWN TO THE TOWN TO THE TENT TOWN TOWN TOWN TOWN TOWN TOWN TOWN TO	INA INS 222 C CCIT SEED Based superformances over 29.000 Based superformances INA INA INA INA INA INA INA INA INA INA	18A RS 732 78 ma content top 75 118 300 500 1200 2400 4800 9600 Baud 18A 18A 18A 18A 18A 18A 18A 18A 18A 18A	E1A 20 ha sphones Ue to 19 296 Eased RA 18A 18A 18A 18A 18A 18A 18A 18A 18A 18	No PS 732 C Up to \$500 Baild synchronous or provide enous MA MA HA HA HA HA HA HA HA HA HA HA HA HA HA	RS 232 C 20 int current one 50 through 19 700 8ps in 19 tres 15A 15A 15A 15A 15A 15A 15A 15
	INA INA INA INA INA INA INA INA INA INA	INA INA Up to 9600 Bps INA INA INA INA INA INA INA INA INA IN	10 11 12 13 14 15 16 16 16 16 16 16 16	INA INA INA INA INA INA INA INA INA INA	18.1 2" 19.1 2" 19.1 2" 19.1 2" 19.1 2" 19.1 2" 19.1 2" 19.1 2" 19.1 2" 19.1 2" 19.1 1	18 A RS 727 This real constant loop 75 118 300 500 1700 7400 4800 9600 Beard IN A IN A IN A IN A IN A IN A IN A IN A	E1A 20 no serionne Up to 19 206 Eased MA /MA INA INA INA INA INA INA INA INA INA IN	No PS 722 C Up to \$500 Baild synchronisks or consists on consists	RS 232 C 20 ms conventions So through 19 700 flox in 19 tres 19 700 flox in 19 tres 19 700 flox in 19 tres 19 700 flox in 19 7
	INA INA INA INA INA INA INA INA INA INA	INA INA Up to 9600 Bps INA INA INA INA INA INA INA INA INA IN	20 ms current long HS 232 C. 10 inters up to 15 2 Alban. INA INA INA INA INA INA INA INA INA INA	112 152 20 500 1290 2400 881 170 170 200 881 170 170 170 170 170 170 170 170 170 17	18.1 7" 21 17" 21 17" 21 17" 21 17" 21 17" 21 17" 21 17" 21 17" 21 17" 22 17" 23 10 65 Ss. 128V/248V 18A 46/50 Hertz 18A Less then 200	18A RS 232 78 me content loop 75 118 300 500 1700 7400 4800 9600 Beard INA INA INA INA INA INA INA INA INA INA	E1A 20 no systema 10 no 19 200 Eased MA -/BA -/BA -/BA -/BA -/BA -/BA -/BA -/B	No PS 722 C Up to \$560 Baud synchronous on consults enous:	RS 232 C 20 His current long 50 through 19 700 day in 15 tires 15 A 16 A 17 N 18 A 18 A 18 A 18 A 18 A 18 A 18 A 18 A
	INA INA INA INA INA INA INA INA INA INA	INA INA Up to 9600 Bps INA INA INA INA INA INA INA INA INA IN	10 rates up to 19.2 Alban INA INA INA INA INA INA INA INA INA IN	INA INA INA INA INA INA	18.4 RS 222 C CC117 5000 Basel supreferences, over 29.000 Basel supreferences over 29.000 Basel supreferences in INA 18.4 IRA 18.4 IRA 18.5 IRA 18.5 IRA 1287/248V 18.6 S0/50 Hertz 18.6 IRA 10.7 IRA 10.	18A RS 737 78 ma con rest top 75 118 300 500 1700 7400 4800 9600 Bood INA INA INA INA INA INA INA INA INA INA	E1A 20 ha sphanes Up to 19 206 Eased MA (MA 1hA 1hA 1hA 1hA 1hA 1hA 1hA 1hA 1hA 1h	No PS 732 C Up to \$568 Baild synchronous or provide enous MA MA HA HA HA HA HA HA HA HA HA HA HA HA HA	RS 232 C 20 Interest one 50 through 19 700 8ps in 19 1991 19A 19A 19A 19A 19A 19A 19A 19A 19
	INA INA INA INA INA INA INA INA INA INA	INA INA Up to 9600 Bps INA INA INA INA INA INA INA INA INA IN	20 ms current long HS 232 C. 10 inters up to 15 2 Alban. INA INA INA INA INA INA INA INA INA INA	HA TO SEE THE	18.1 7" 21 17" 21 17" 21 17" 21 17" 21 17" 21 17" 21 17" 21 17" 21 17" 22 17" 23 10 65 Ss. 128V/248V 18A 46/50 Hertz 18A Less then 200	18A RS 232 78 me content loop 75 118 300 500 1700 7400 4800 9600 Beard INA INA INA INA INA INA INA INA INA INA	E1A 20 no systema 10 no 19 200 Eased MA -/BA -/BA -/BA -/BA -/BA -/BA -/BA -/B	No PS 722 C Up to \$560 Baud synchronous on consults enous:	RS 232 C 20 His current long 50 through 19 700 day in 15 tires 15 A 16 A 17 N 18 A 18 A 18 A 18 A 18 A 18 A 18 A 18 A
	INA INA INA INA INA INA INA INA INA INA	INA INA Up to 9600 Bps INA INA INA INA INA INA INA INA INA IN	10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 11 sters up to 19.7 Alam 12 sters up to 19.7 Alam 12 sters up to 19.7 Alam 12 sters up to 19.7 Alam 13 sters up to 19.7 Alam 14 sters up to 19.7 Alam 15 sters up to 19.7 Alam 17 sters up to 19.7 Alam 18 sters up to 19.	INA INA INA INA INA INA INA INA INA INA	18.1 2" 13" 13" 13" 13" 13" 13" 13" 13" 13" 13	18 A RS 232 75 me content loop 75 118 300 500 1700 7400 4800 9600 Bood 18 A RA	E1A 20 no systems Up to 19 206 Eased MA /BA IRA IRA IRA IRA IRA IRA IRA IRA IRA IR	No. 722 C Up to \$560 Band conchronous on security enough	95 232 C 20 ms correct ong SO
	INA INA INA INA INA INA INA INA INA INA	INA INA Up to 9600 Bps INA INA INA INA INA INA INA INA INA IN	10	112 152 100 500 1290 2400 4841 9800 885 Tri Tri Tri Tri Tri Tri Tri Tri Tri Tr	18.4 RS 222 C CC117 18080 Basel superferences, over 29.000 Basel superferences, over 29.000 Basel superferences 118.4 IRA 18.4 IRA 18.4 IRA 18.5 IRA 18.5 IRA 18.6 S050 Best 1289/2489 IRA 6050 Hertz 18.6 IRA 18.6 IRA 18.6 IRA	18A RS 732 78 ma content loop 75 118 300 500 1700 7400 4800 9600 Bood INA INA INA INA INA INA INA INA INA INA	E1A 20 ha sphanes Up to 19 206 Eased MA (MA 1hA 1hA 1hA 1hA 1hA 1hA 1hA 1hA 1hA 1h	No PS 732 C Up to \$600 Band synchronous on president enous 1 MA MA 18A 18A 18A 18A 18A 18A 18A 18A 18A 18	RS 232 C 20 Interest one 50 through 19 700 8ps in 19 tress 1NA 1NA 1NA 1NA 115V 10V 238V 10V 1NA 1NA 1NA 1NA 1NA 1NA 1NA 1NA 1NA 1NA
	INA INA INA INA INA INA INA INA INA INA	INA INA Up to 9600 Bps INA INA INA INA INA INA INA INA INA IN	10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 10 sters up to 19.7 Alam 11 sters up to 19.7 Alam 12 sters up to 19.7 Alam 12 sters up to 19.7 Alam 12 sters up to 19.7 Alam 13 sters up to 19.7 Alam 14 sters up to 19.7 Alam 15 sters up to 19.7 Alam 17 sters up to 19.7 Alam 18 sters up to 19.	INA INA INA INA INA INA INA INA INA INA	INA INS 222 C CC117 S000 Basel superformers, over 79.000 Basel superformers. INA INA INA INA INA INA INA INA INA IN	18 A RS 232 75 me content loop 75 118 300 500 1700 7400 4800 9600 Bood 18 A RA	20 no systems Up to 19 206 Eased MA	No PS 722 C Up to \$500 Baild synchronists or consists	RS 232 C 70 ms conventions 50 through 19 700 fbs in 15 tres 15A 15A 15A 15A 15A 15A 15A 15A 15A 15
	INA INA INA INA INA INA INA INA INA INA	INA INA Up to 9600 Bps INA INA INA INA INA INA INA INA INA IN	10 ms current long 15 2 22 C	112 152 100 500 1290 2400 4841 9800 885 Tri Tri Tri Tri Tri Tri Tri Tri Tri Tr	18.4 RS 222 C CC117 18080 Basel superferences, over 29.000 Basel superferences, over 29.000 Basel superferences 118.4 IRA 18.4 IRA 18.4 IRA 18.5 IRA 18.5 IRA 18.6 S050 Best 1289/2489 IRA 6050 Hertz 18.6 IRA 18.6 IRA 18.6 IRA	18A RS 737 75 not content loop 75 118 300 500 1200 7400 4800 9600 Bood 18A 18A 18A 18A 18A 18A 18A 18A 18A 18A	E1A 20 no serionnel Up to 19 706 Eased MA /REA 1NA 1NA 1NA 1NA 1NA 1NA 1NA 1NA 1NA 1N	No PS 732 C Up to \$600 Band synchronous on president enous 1 MA MA 18A 18A 18A 18A 18A 18A 18A 18A 18A 18	RS 232 C 20 Interest one 50 through 19 700 8ps in 19 tress 1NA 1NA 1NA 1NA 115V 10V 238V 10V 1NA 1NA 1NA 1NA 1NA 1NA 1NA 1NA 1NA 1NA

APPENDIX B - KEYBOARD DISPLAY TERMINAL (KDT) CHARACTERISTICS AND EQUIPMENTS 71/72

	Name Name Andrews	26 Honeywell Information	21 Human Dangered Systems (nc.	22 MSA: Manufactoring	23 Jacquard Systems	24 Hazelitine Corp. Computer	Nomen Parkers	N N N N N N N N N N N N N N N N N N N	31	
		Systems		Cers		Terminal Equipment	•	- mrg 04		
	Medes Rumber Cost Annge	VIP 1285	CONCEPT 100	VOF 64	31 95 V descampator	Moderay One Paining	7846A		1/5*A# 3	æ
5	Available agtions	Features of VIP 7198 7185 or VIP 7298	Multiple character sets additional function keys		Expansion to 128K Bytes of storage	184	\$3100 to \$7000	- 1 4.4 		. 1441.
	Typomiter seypod	Yes	•	Yes	•	·	•	1		
,	Numeric heyped	7=	Yes Yes	Tm.	Y m.	Yes Yes	Tas Tas	***	'a 'a	'*
	Cursor control keyped	Yes	Yes	INA	Yes	Yes	Y 66	***	7 m	٠,,
•	General purpose function keys luser defined	Y=	Yes	IRA	Y	`m	**	16	*•	' . .
18+	Edit koys TTY koyboard	Yes Yes	Y na No	INA INA	Y ma Ma	Yes INA	t se No	*** ***	TM.	
12	Key modes	IRA	INA	INA	IRA	INA	19.8	-NA	18.6	- 1
13	Detachable seyboard	Yes	Ym	INA	*=	Y 04	785	¹ en	**	165
14	Repeat on keys	INA .	Yes	rik A	INA.	INA.		44	44	12
15 16	N-key roklaver Keylack mintch	Yes IRA	INA INA	Yes INA	Yes NA	19.A 19.A	7 01 1% A	ing di	n A	N2 1
17	Lighted keys	INA	INA	INA	INA	INA	IN A	NA.	44	92
	Impley Copediality						•	•	•	. 1
18	Non-glare scroon Character set	INA 128 ASCII and control	Yes 128 ASCII	INA 256	Yes ASCII	Y 85	INA 124	*** *20 ASC**	764	4.3
28	Unaracter set Tight screen		Yes	No.	No.	128 ASCH No	126 No.	No ASE	178 ASC	64 1 (
21	Survey screen	No	Yes	No	No	No	No	No.	No.	•.
22	Programmable brightness	Ym	Yes	INA	INA	Ym	Yes	-MA	IN A	% ±
23	No of levels	Two 24	Two 24	1M.A. 24	INA	Twe	Texa	-4-A 24	· NA	4.3
24 25	Number of lines Characters per line	80	80	24 86	24 80	24 80	24 20	74	24 80	25
25	Reverse vides (programmable)	INA	Yes	Yes	INA	Yes	**	***	10	1943
27	Birnking (programmable)	INA	Yes	INA	INA	Y as	Yes	18	Tes	4.1
28.	Screen uze	12 diagonal	12' diegonal INA	12 diagonal INA	12" diegonal	12 diagonal	5 X 10	12 diagonal	12 diagonal	13 3 44
. 30	Non-display field for security Calor display capability	NA None	INA Name	NA None	INA INA	Y se None	ifq A None	i Na A None	rhA Nom	4.4
31 -	Cursor Suprey Capability								None	•
32	control (kwy. program or both)	Key and program	Key and program	INA	Key	Key and program	Key	Rey and program	Res.	Re.
33	type (blinking, underline, reverse video, etc.)	Reverse video and blinking	Blinking underline or blinking	INA	INA :	Block or underline	Blinking undertine	INA	in A	White se
34	addromable	Yes	Yes	INA	INA	Yes	INA	Yes	·NA	undersch -Na
35	Dot Matrix for characters	5 X 7	7 X 9	INA	INA	7 X 9	7 x 9	9 x 9	5 % 1	5.
36 :	(8 X 10, 10 X 16, etc.) Status desplays (inphts or line on CRT)	INA :	Line on CRT	INA	INA	Laghts	ŀNA	IN ∆	I N.A.	N A
37	Flicker free	INA	Eme on Civi	INA	Yes	Yes	17-		144	7.0
38	refresh screen data rate	60 Hertz	68 Hertz	INA	! INA	60 Martz	60 Hertz	50 or 60 Mertz	50 or 60 Hertz	66 ······
30	phosphor type (e.g., P-4)	INA	P-4	INA	INA	P-4	P.4	P 4	P.4	% 4
40	Momery size for deplay	1920 cherectors	INA	INA	INA	INA	11 000 bytes	INA	INA .	44
	Compose and Fairt Feetures		,				*****		•	•
41	Erase to end of line Erase to end of page	Yes	Yes Yes	INA INA	INA INA	Yes INA	INA INA	INA	INA INA	INA INA
43	Character delets	INA		Yes	Yes	Yes	Yes	Yes	Yes	Ten
44	Line delets	INA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	78
45	Clear screen Character aversents	INA INA	Yes INA	INA INA	INA INA	Yes INA	Yes INA	Yes INA	Yes Ina	ilika dika
47	Character insert	INA	Yes	Yes	Yes	Yes	Yes	Tes	Yes	7.01
48	Linz insert	INA	Yes	Yes	INA	Yes	Yes	Yes	Yes	Tes.
49	Backspace	INA	Yes	INA	INA	Yes	Yes	Yes	No	I Ny A
50	Forward tab Backward tab	INA	Yas	ina ina	Yes	Yes	Yes No.	Tra .	Yes	Yes
51	Adjust space and line automatically	INA INA	Yes INA	INA	Yes INA	Yes INA	No INA	Yes INA	Yes INA	1944 1944
-	when characters, words, or									
	sontoness are added or defeted (word wrop)						:			
53	Autometically change paging when	INA	INA	INA	INA	INA	INA	(NA	INA	in a
54	odditions or deletions are made Clear ungretected data	INA	Yes	INA	INA	Yes	INA	+NA	in A	/NA
55	Scroll up or down	Up Mode	Up or down	INA	INA	INA	up or down	INA	Scroll up	Service
56	Audible sterm for end of line	Yes	INA	IMA	INA	INA	INA	INA	INA	18,4
57	Audible starm for and at page	INA	INA	INA	INA	INA	INA	INA	ina ' ina	194.4
340 540	Automatic paging Protected fields (programmable)	INA INA	INA Yes)MA Yes	INA INA	INA Yes	INA Yes	INA Yes	' INA Yes	INA INA
80	Curser central from keyboard	Yes	Yes	INA	Yes	Yes	Yes	'es 'es	Yes	Yes
61	Line number display	INA	IRA	INA	INA	INA	INA	INA	Yes	1NA
62	Column number display	INA	INA	INA	INA	INA	INA	INA	INA	INA
63	Word search for delete or replace	INA	INA V	IRA IRA	INA INA	INA INA	INA V	INA	INA INA	INA INA
84 85	Nort page Provious page	INA INA	Yes Yes	INA INA	INA INA	IRA IRA	Yes Yes	INA INA	INA	' INA
86	First page	INA	INA	INA	INA	INA	N:	INA	INA	IRA
	Communication Interface and Control Type interface	RS-232-¢	R\$-237-C	INA	INA	R\$-232	RS-232	HS-232-C	RS-232-C	RS 232
1 1		29 me current leep er 80 me current leep 75, 118, 159, 388, 666, 1298,	26 ms current	6 66 to 66 W.Jham.*		116, 280, 300, 600, 1296,	26 ma current leep 110, 150, 390, 1290, 2400	20 or \$6 ms current leep 56, 75, 118, 134.5, 156, 200,	20 of 80 me current loop	110 Bevd
امدا	Transmission rates	75, 110, 150, 360, 500, 1200, 1800, 2460, 4800, 9860 Bond retes soluctable	50 - 9600 Baud (15 rates)	8.05 to 56 Krishaud		2406, 4808, 9600 Roud	4880, 9600 Boud	300, 800, 1280, 1800, 2480, 3600, 4800, 7200, 9680, 19,200 bits per second	50, 75, 110, 134.5, 150, 300, 600, 900, 1200, 1800, 2400, 3800, 4800, 7200, 9600 bris per second	(14 ratm/
	Parameter and				INA	INA	INA	INA	Yes	IRA
	Transmission modes	Yes	Yes	IMA					-	1
	Transmission medics character at a time line at a time		Yes INA	INA INA	INA	INA	INA	INA	No.	INA
100 76 71 72	character of a time line at a time full surane at a time	Yes Yes Yes	INA INA	INA IMA	INA INA	INA	INA	Yes	Yes	INA
100 76 71 72 73	character of a time lice at a time full serven at a time partial serven at a lin-,	Yes Yes Yes INA	INA INA INA	INA IMA IMA	INA INA INA	INA INA	INA INA	Yes	Yes Yes	INA
100 76 71 72	character of a time line at a time full surane at a time	Yes Yes Yes	INA INA	INA IMA	INA INA	INA	INA INA	Yes	Yes	INA
100 76 71 72 73 74 75 75	character of a time line at a time full serven at a time partial serven at a time partial serven at a time markelple pages at a time	Yes Yes Yes INA	INA INA INA INA	INA INA INA INA	INA INA INA INA	INA INA INA	INA INA INA	Yes Yes INA	Yes Yes INA	IRA IRA IRA
100 76 71 72 73 74 75 75	character of a time Here of a time full surrow of a time partial serom of a tim-, mortispic pages of a time putting	Yes Yes Yes INA	INA INA INA INA INA	INA IMA IMA IMA IMA	INA INA INA INA INA	INA INA INA Yes	INA INA INA	Yes Yes INA Optional	Yes Yes INA IMA	INA INA INA
100 76 71 72 73 74 75 75	character of a time Here of a time full surrow of a time partial serom of a tim-, mortispic pages of a time putting	Yes Yes Yes INA	INA INA INA INA INA	INA IMA IMA IMA IMA	INA INA INA INA INA	INA INA INA Yes	INA INA INA	Yes Yes INA Optional	Yes Yes INA IMA	INA INA INA
100 76 71 72 73 74 75 75	character of a time Here of a time full surrow of a time partial serom of a tim-, mortispic pages of a time putting	Yes Yes Yes INA	INA INA INA INA INA	INA IMA IMA IMA IMA	INA INA INA INA INA	INA INA INA Yes	INA INA INA	Yes Yes INA Optional	Yes Yes INA IMA	INA INA INA
100 76 71 72 73 74 75 75	character of a time Here of a time full surrow of a time partial serom of a tim-, mortispic pages of a time putting	Yes Yes Yes INA	INA INA INA INA INA	INA IMA IMA IMA IMA	INA INA INA INA INA	INA INA INA Yes	INA INA INA	Yes Yes INA Optional	Yes Yes INA IMA	INA INA INA

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INA.	\$4405 to \$5005	Graphics	19.6	Div. 1 4/15	Graphics and projection		•		.4.
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	INA	INA	INA	-hA	Yes	INA	INA	19A	Tes
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Yes	INA	INA	Yes	78	INA.	141	Yes	INA.	.44
	64 ASCII	INA	128 ASC#	*26 ASC:	SE ASCH	128 ASC#	54	96 ASCH	128 ASCH
	No	No	No	Nc.	No	No	No.	**	••
	No.	No	No.	No.	No No	Ne Yes	No Yes	No.	No Y m
	INA INA	ina Ina	Yes T ar o	tes Texto	No	Twe	Tero	tee	Terr
	25	32 or 51	24	75	32 er 51	24	24 mp to 32	74	24
	80	64 or 85	80	80	64 or 85	60	M	16	30
Yes	INA	INA	INA	Yes	Yes	INA .	Yes	Yes	Yes
	INA	INA	Yes	16	INA	Y 95	Yes	Ye.	Yas
	13' diagonal	12 1 4' X 12 1 4 (pleaner)	12 diagonal	15 zagonat	812' X 812 MA	12 diagonal Yas	15 diagonal Yes	12 diagonel (NA	15 diagonal (8A
	INA 8 colors	Nean Orange	Yes Na	rea None	INA	Green	Yes Optional	Hone	Name
		er e empe							
INA	Key White blinking overstore	INA Inverted L	Nev and program INA	ke. :48	Key and program Underline	: Key Blinking black	Program Underscore optional	Key and program Block or underscore	Key and program Blinking understore or ble
	underscore IN A	INA	Yes	44	Yes	† HRA	blinking block Yes	Ym	184
	5 X 7	7 X 9 or 5 X 7	5 x 9	1 x 9	7 X 8 or 5 X 7	. 7 X D	7 X 8	7 X \$	7 X 7 or 7 X \$
INA	INA	·	CRT lines	25th ine un CRT	· INA	Lights 176 A	Lights	INA	INA
50 or 80 Hertz	60 times:second	Yes.	68 helds per second	60 Hety	The INA	INA	60 fields per second	INA	60 Hertz
24 P-4	INA	INA	P-4	INA	INA	P-31	INA	, P4	P.4
INA	48 lines of 80 characters/line	4335 characters (5 X 7)	INA	i N ₁ A	INA	INA	INA	INA	1826 characters atd. up to
· · 		2048 characters (7 X 9)		•	·	+	•		1\$ 200 characters optional
(NA	INA	INA	INA	INA	INA	INA	INA	Yes	Yes
	IMA	INA	INA	, INA	(NA	INA	INA	Y ms	Yes
Yes	Yes	INA	Yes	Yes	Yes	Programmable	INA	Yes	Yes
	Yes INA	Yes	Yes Yes	te te	'INA Yes	No INA	INA INA	Yes Yes	Yes
	INA	INA	INA	14.3	Yes	INA	INA	INA	Yes INA
	Yes	INA	Yes	¹n	Yes	Programmable	INA	Yes	Yes
Yes	Yes	i INA	Yes	••	INA	· INA	INA	Yes	Yes
	INA		INA	N .	Yes	INA	INA	; Yes	INA
	Yes	INA	Yes	***	Yes	INA	INA	Yes	Yes
	INA INA	INA INA	INA INA	154	INA INA	INA Programmable	INA INA	I Yes	INA
	144		17.5	134		:	144	,	· INA
INA	INA	INA	INA	N 4	!NA	Programmujale	· INA	Lina	INA
i				•		1	İ		
IRA	INA	I&A	INA	14A	- INA	INA	INA	Yes	INA
		INA .	INA .	up or fown	INA	Programmable	INA	INA	Up or down
	INA INA	INA - INA	INA INA	1ALA	IRA IRA	INA	INA INA	INA INA	Programmable
	INA	INA	INA	INA INA	, INA INA	INA	INA	INA	Programmable INA
	INA	INA	Yes	Yes	INA	Yes	INA	Yes	Yes
Yes	Yes	INA	Yes	Yn.	Yes	Yes	INA	Yes	Yes
	INA	INA	INA	TRA	INA	INA	INA	INA	INA
	INA	INA INA	INA	INA	INA	INA	INA	IMA	INA
1 ·	IRA IRA	INA	INA INA	INA V	INA INA	Programmable INA	INA INA	INA	INA
	INA	INA	INA	Yes Yes	INA	IRA	IRA	INA INA	Yes Yes
	INA	INA	INA	INA	INA	INA	INA	INA	INA
	_ _	MHL-STD-188C	RS-232-C	RS 232-C	RS-232	RS-232-C RS-422	INA	RS-232-8	RS-232-C
#8-232-C	RS-232-C	R\$.232.0	ļi .			NS-422 Secol data up to 38.4K	50 to 39,400 Bond	RS-232-C Current loop 110, 300, 600, 1200	20/60 me current loop optional Up to 96/80 Bond
29 or 90 mg current loop		RS-232-C 156 to 19,200 Bood	110 150 300 sen 1200	75 to 9600 Rend	50 to 7455 Said			· · · · · · · · · · · · · · · · · · ·	
20 or 00 ma current loop 50, 75, 119, 134.5, 150, 300, 980, 980, 1280, 1680, 2460, 3600, 4600, 7280, 1680 bes	RS-232-C 178 Band to 76 BK Saud (14 resul)		116, 150, 300, 600, 1200, 2466, 4600, 9600 Bood	75 to 9600 Soud	50 to 24 06 B ood	Boud; Special parallel, up to 10,000 character/ sec.	pered, 29,900 char- actors per second	2400, 4000, 9600, 19,200 Band	
20 or 00 ms current loop 56, 75, 110, 124.5, 150, 300, 660, 960, 1260, 1660, 2460, 3600, 4660, 7290, 9660 hts per smootd	118 Band to 76 BK Blood (14 rates)	150 to 19,200 Based	2496, 4890, 9660 Boud			Bond: Special perollol, up to 18,000 character/ sec.	parel, 29,000 char- actors per second perellel	19,290 Band	V
28 or 90 ma current loop 96, 75, 110, 124.5, 156, 266, 960, 960, 1260, 1660, 2466, 3660, 4666, 7250, 8660 bits per strond	316 Band to 76 6K Bland (14 rates)		2466, 4900, 9690 Boud	Yeş	Yes	Bond: Special perollel, up to 10,000 character/ sec.	perul, 29,800 characters per second purulet	19,200 Band	Yes Yes
20 or 80 ma current loop 50, 75, 110, 134.5, 150, 300, 600, 100, 1200, 1000, 2400, 3000, 4000, 7200, 8000 birs per siscend Yes	118 Band to 76 BK Blood (14 rates)	156 to 19,266 Basel	2496, 4890, 9660 Boud	Yes Yes		Bond: Special perollol, up to 18,000 character/ sec.	parel, 29,000 char- actors per second perellel	19,290 Band	Yes Yes Yes
20 or 00 ma current loop 90, 75, 119, 124 5, 150, 306, 801, 905, 1295, 1995, 2005, 3006, 4006, 7290, 9000 bets per steened You You You	118 Sand to 76 SK Shed (14 rates) IRA IRA IRA	150 to 19,200 Board INA INA	2466, 4900, 9696 Boud INA Yes	Yeş	Yos IMA	Bond: Special perollol, up to 10,000 character/ sec. INA INA	perud, 29,900 cher- actors per second peruhal (NA 101A	IRA IRA	Yes
20 or 00 ma current loop 50, 75, 119, 124.5, 150, 300, 600, 500, 1200, 1000, 2400, 2000, 5000, 7200, 50000 bets par second 7700 No Yes Yes 166A	118 Band to 76 SK Smid (14 retps) IMA IMA IMA IMA IMA	158 to 19,200 Sould INA INA INA INA	2406, 4800, 5800 Baud INA Yos Yos Yos INA	Yes Yes Yes	You IMA IMA	Serve: Spaced persitor, up to 18,000 character/ 1985. INA INA INA INA INA	sered, 29,800 cheractors per second persons (NA INA INA INA INA INA	19.200 Band INA INA INA INA INA INA INA	Yes Yes Yes INA
28 or 88 ma current loop 90, 75, 119, 134.5, 189, 389, 805, 989, 1289, 1698, 2488, 389, 3998, 7599, 9898 bets per manend Yes Yes Yes Yes 185A	178 Send to 76 SK Shed (14 reter) IMA IMA IMA IMA IMA IMA	150 to 19.200 Sould INA INA INA INA INA INA	2406, 4800, 5800 Bood INA Yes Yes Yes INA Yes	Yes Yes Yes Yes iNA Optoposi	Yee IRA IRA IRA IRA	Soud: Special persitol, up to 18,000 character/ 185. INA INA INA 186A 586A 180A	sered, 29,000 cher actors per second perullel INA INA INA INA INA	19.200 Sund IRA IRA IRA IRA IRA	Yes Yes Yes IMA
20 or 00 ma current loop 50, 75, 119, 124.5, 150, 300, 600, 500, 1200, 1000, 2400, 2000, 5000, 7200, 50000 bets par second 7700 No Yes Yes 166A	118 Band to 76 SK Saud (14 retps) IMA IMA IMA IMA IMA	ISO to 19.200 Board INA INA INA INA INA INA INA INA INA INA	2406, 4800, 5800 Baud INA Yos Yos Yos INA	Yes Yes Yes Yes IMA	Yee IRA IRA IRA	Serve: Spaced persitor, up to 18,000 character/ 1985. INA INA INA INA INA	sered, 29,000 cher actors per second perallul (NA INA INA INA	19.200 Band INA INA INA INA INA INA INA	Yes Yes Yes INA
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200 200	RS 232-C 29 or 50 ma current loop 50, 75, 110, 134 5, 150 300 608, 900, 1200 1800, 2400, 3600, 4800, 7200, 9606 brts	RS-232-C	MIL STD 188C RS-232 C	RS-232 C	HS 232 C	RS-232	RS 232-C RS-422 Serial data up to 38 4K Baud. Special parallel, up to 10,000 character	IN A 50 to 38 400 Bould serial 20,000 chair acters per second	RS-232 B RS-232-C Current loop	RS 232 C 20 40 ms current leas aptional
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	RS 232-C 28 or 50 ma current loop 50, 75, 110, 134-5, 150, 300, 608-900, 1200, 1800, 2400, 3800, 4800, 7200, 9600 brts per second	RS-232-C 110 Boud to 75 8K Boud (14 rates)	MIL STD 188C RS-237 C 150 to 19.200 Boud	RS 232 C 110 150 300 600 1200 2400 4800 9600 Baud	HS 232 C	RS-23Z 50 to 2400 Soud	RS 232-C RS-422 Serval data up to 38-4K Boud. Special parallel, up to 18,000 character sec	1NA 50 to 38 400 Bould serial 20 000 chair actors per second parallel	RS 232 8 RS 232 C Guttent loop 110 380 680 1290 2400 4800 9600 19 200 Baud	RS 232 C 2846 ma current lead sphanel Up to 9500 Boud
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	RS 222-C 29 or 60 ma current toop 50, 75, 110, 134 5, 150, 300, 608, 900, 1200, 1800, 2400, 3800, 4800, 7200, 9606 birts per second Yes No Yes	RS-232-C 118 Seud to 75 8K Seud (14 rates) INA INA INA	MIL STD 188C RS-237 C 150 to 19.200 Boud INA INA INA	RS 232 C 110 150 300 600 1200 2400 4800 9600 8evd INA Yes Yes	#\$ 222 C	RS-232 50 to 2400 Bourd Yes INA INA	RS 232 C RS 422 Serval data up to 38 4K Baud. Special pursibil up to 10,000 character sec. INA INA INA INA	1NA 50 to 38 400 Beard served 20 000 characters per second perallel 1NA 1NA 1NA	RS 222 B RS 222 C Current teep 110 300 660 1200 2400 4800 8600 19 200 Based	RS 232 C 20 50 me current lead spread Up to 9506 Boud Yes Yes Yes
	RS 232-C 28 or 60 ma current toop 50, 75, 110, 134 5, 150, 300, 600, 900, 1200, 1800, 2400, 3800, 4800, 7200, 9800 brts per second Yes No Yes	RS 232-C 310 Boud to 75 8K Boud (14 rates) INA INA INA INA	MPL STD 188C RS-232 C 150 to 19,200 Saud INA INA INA INA	RS 232 C 110 150 300 600 1200 2400 4800 9600 8eva INA Yes Yes INA	HS 222 C 75 to 9600 Bead Yes Yes Yes In A	PS-237 50 to 2400 Boud Yes INA INA INA	RS 232 C RS 422 C Serval data up to 38 4K Baud Special parallel up to 10,000 character UNA INA INA INA	INA 50 to 38 400 Board serial 70 000 Characters per second pareful INA INA INA INA INA	RS 232 B RS 232 C Current teep 110 300 600 1200 2400 4800 8600 19 200 8600 1NA INA INA INA	RS 237 C 28 96 ms current leep optomal Up to 9608 Board Yes Yes Yes IN A
	RS 232-C 29 or 60 ma current toop 50, 75, 110, 134 5, 150, 300, 500, 900, 1200, 1800, 2400, 3600, 4800, 7200, 9600 bits per second Yes No Yes Yes	RS 232-C 119 Boud to 76 8K Boud (14 rates) INA INA INA INA INA	MIL STD 188C RS-237 C 150 to 19 200 Baud INA INA INA INA INA INA	RS 232 C 110 150 300 500 1200 2400 4800 9500 Bevd INA Yes Yes INA Yes	HS 222 C 75 to 9600 Bend Yes Yes Yes Hs A Optional	RS-232 50 to 2400 Baue INA INA INA INA	RS 232 C RS 422 RS 422 RS 422 RS 424	INA SG to 38 400 Read serial 20 006 char actions per second perceivel INA INA INA INA INA INA	RS 232 B RS-232 C Current teep 110 300 880, 1290 2400 4800 8600 19 200 8800 INA INA INA INA INA	RS 232 C 2040 ms current loop sphonal Up to 9600 Board Yes Yes Yes Yes INA
	RS 232-C 28 or 60 ma current toop 50, 75, 110, 134 5, 150, 300, 600, 900, 1200, 1800, 2400, 3800, 4800, 7200, 9800 brts per second Yes No Yes	RS 232-C 310 Boud to 75 8K Boud (14 rates) INA INA INA INA	MIL STD 188C RS-232 C 150 to 19,200 Boud INA INA INA INA INA INA INA	RS 232 C 110 150 300 600 1200 2400 4800 9600 8eva INA Yes Yes INA	HS 222 C 75 to 9600 Bead Yes Yes Yes In A	PS-237 50 to 2400 Boud Yes INA INA INA	RS 232 C RS 422 C Serval data up to 38 4K Baud Special parallel up to 10,000 character UNA INA INA INA	INA 50 to 38 400 Board serial 70 000 Characters per second pareful INA INA INA INA INA	RS 232 B RS 232 C Current teep 110 300 600 1200 2400 4800 8600 19 200 8600 1NA INA INA INA	RS 237 C 28 96 ms current leep optomal Up to 9608 Board Yes Yes Yes IN A
	RS 232-C 29 or 60 ma current toop 50, 75, 110, 134 5, 150, 300, 500, 900, 1200, 1800, 2400, 3600, 4800, 7200, 9600 bits per second Yes No Yes Yes	RS 232-C 119 Boud to 76 8K Boud (14 rates) INA INA INA INA INA	MIL STD 188C RS-237 C 150 to 19 200 Baud INA INA INA INA INA	RS 232 C 110 150 300 500 1200 2400 4800 9500 Bevd INA Yes Yes INA Yes	HS 222 C 75 to 9600 Bend Yes Yes Yes Hs A Optional	RS-232 50 to 2400 Baue INA INA INA INA	RS 232 C RS 422 RS 422 RS 422 RS 424	INA SG to 38 400 Read serial 20 006 char actions per second perceivel INA INA INA INA INA INA	RS 232 B RS-232 C Current teep 110 300 880, 1290 2400 4800 8600 19 200 8800 INA INA INA INA INA	RS 232 C 2040 ms current loop sphonal Up to 9600 Board Yes Yes Yes Yes INA
	RS 232-C 29 or 60 ma current toop 50, 75, 110, 134 5, 150, 300, 500, 900, 1200, 1800, 2400, 3800, 4800, 7200, 9800 bits per second Yes No Yes Yes Yes	RS 232-C 119 Boud to 76 8K Boud (14 rates) INA INA INA INA INA	MIL STD 188C RS-232 C 150 to 19.200 Boud INA INA INA INA INA INA INA INA INA INA	RS 232 C 110 150 300 500 1200 2400 4800 9500 Bevd INA Yes Yes INA Yes	HS 222 C 75 to 9600 Bend Yes Yes Yes Hs A Optional	RS-232 50 to 2400 Baue INA INA INA INA	RS 232 C RS 422 RS 422 RS 422 RS 424	INA SG to 38 400 Read serial 20 006 char actions per second perceivel INA INA INA INA INA INA	RS 232 B RS-232 C Current teep 110 300 880, 1290 2400 4800 8600 19 200 8800 INA INA INA INA INA	RS 232 C 2040 ms current loop sphonal Up to 9600 Board Yes Yes Yes Yes INA
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	R5 232-C 28 or 80 ma current toop 50, 75, 110, 134 5, 150, 300, 608 900, 1290 1800, 2400, 3800, 4800, 7200, 9800 bris per second Yes No Yes 1NA 1NA	RS 232-C 110 Boud to 76 8K Boud (14 rates) INA INA INA INA INA INA INA IN	NEL STD 188C RS-232 C RS-232 C RS-232 C RS-232 C RS-232 C RS-232 RS-24 RS-242 RS-24	RS 232 C 110 150 300 600 1200 2400 4800 9600 Beud INA Yes Yes Yes INA Yes INA Yes	HS 232 C 75 to 9600 Bead 75 to	RS-232 50 to 2400 Boud Yes INA INA INA INA INA INA	RS 232 C RS 422 Seval data up to 38 4K Band Special parallel up to 10,000 character six INA INA INA INA INA INA INA INA INA INA	INA 50 to 38 400 Beard serial 20 000 chair schirin per sacond peraller INA INA INA INA INA INA INA INA INA INA	RS 232 B RS-232-C Current teep 110 300 800 1200 2400 4800 8000 19 200 8eed INA INA INA INA INA INA INA INA	RS 237 C 20 90 ma current loop sphonal Up to 9600 Board Yes Yes Yes INA INA
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APPENDIX B - KEYBOARD-DISPLAY TERMINAL (KDT) CHARACTERISTICS AND EQUIPMENTS

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1 Irom Numbe Perhins Elmer Data System Terminal Division or INTERDATA SORDE Systematics General Carp NSL De 40 - Data Druptev System DWL 1200 1200 Serves T IQ 120 Termina 15145 INA INA \$4950 \$8586 \$5950 \$10.000 \$1995 Typewriter keypa Yes Yes No Yes Y #5 ¥ 01 Curser control keyped Yes General purpose function key luser defined, ٧m Yes Yes No 1 40 i N A INA 10 Edit bevs Y #4 Yes ٧. Yes TTY keyboard INA INA No No No No ** 12 INA INA INA INA Key modes INA INA IN A Betachable keyb Yes No Yes 7 05 No INA Yes INA INA 14 A 15 N key relieve INA INA 116 Keylock purter INA INA INA INA INA INA Lighted keys Yes INA INA MA IN A Display Capability 18 Yes Non glare screen Yes INA Yes 7 01 INA 112 Character set 128 ASCH 127 ASCH 96 ASCII 128 ASE11 96 ASCII 54 upper case 29 Tult screen No No 21 No No Yes No No 22 Yes Programmable to Yes Yes Yes Y e1 INA Ym No of levels Two Two 23 Twe Two T wo INA fwa 24 25 24 24 24 24 24 24 74 80 80 80 80 80 80 26 Yes Yes INA INA 27 Stoking (programmable) Yes Yes Yes INA YH INA 14" die 5 3/4 x 10 1/4 71 Screen size 12" diseans 12" dia 12 d 5 . 10 12 29 INA Non-drapiay held for set Yes INA INA Yes INA INA INA None None None None None 31 32 Key Key Key 33 type (blinking, underline reverse video atc -INA INA IRA INA 34 INA 35 Dot Matrix for characters (8 x 10, 18 x 16, etc.) 13 x 9 9 x 12 7 x 11 5 x 7 5 x 9 1 x 9 3 . 9 136 INA INA Lights and CRT Status displays (bahts or line on CRT) CRT : INA -Flicker free 60 Hertz 38 refresh screen data rate 60 fields/second SO Herta INA phosphor type (e.g. P.4) INA P4 INA INA INA IRA 1920 ch INA INA INA INA up to 5760 option Compose and Edit Feature INA INA Yes INA INA Erage to end of line Yes INA INA INA INA Yes INA INA 42 Erest to end of page Yes INA Yes 44 Line delete INA Yes Yes Yes Yes Yes 7 05 INA Yes INA Yes Yes 45 Clear screen Yes Yes INA INA INA INA INA INA Yes Character ove INA Yes INA Yes Yes INA Yes Yes INA Yes Yes Yes INA INA 49 No INA INA Yes INA INA Yes Yes معا Yes Yes Yes INA INA Yes No ≀NA Yes INA INA 51 **Backward** tab 52 Adjust space and line automatically characters, words, or sentences added or deleted. (word wrap) INA Yes INA INA INA INA INA INA INA INA INA Autometically change paging when additions or deletions are made INA INA INA INA Clear unprotected data MA Seroll INA INA INA Up or d Up or 55 Scraff up at down Audible sterm for end of line INA INA INA INA INA INA INA INA INA INA INA INA INA INA INA INA INA INA 54 59 INA INA INA INA Yes Yes INA Yes Yes Yes Protected fields (pro-INA Yes Yes Yes Yes 80 61 62 Yes Yes Cursor control from keyboard INA INA INA INA INA INA INA INA INA INA Line number display Column number display 63 INA INA INA INA INA INA INA Next page INA INA INA INA INA Yes INA 85 1966 INA -INA INA Yes INA INA INA INA 86 First page INA INA INA INA Communication Interface and Control RS-232-C; 20me current MIL-\$TD-188C MIL-\$TD-188C-108 INA INA RS 232 C Type inte RS-232-C MIL STD-188C optional MIL STD-188-198 optional MIL STD-188-114 optional 75, 110, 200, 300, 600, 1200, 1000, 2400, 4000, 7200, 9000 Band 118, 158, 300, 600, 1290, 2400, 4800, 9600 Band 110, 150, 300, 1200, 2400, 4800, 9600 Baud INA 110 to 2400 Baud 75 to 19,200 bps, 118 to 9680 bit Yes 79 or at a time Yes INA Yes Yes Optio Yes INA Yes 71 INA Yes Yes Optio Yes INA 12 INA INA IRA INA Yes INA 73 INA INA INA INA INA INA INA 74 78 Yes INA INA FNA Opt Opt Yes INA IRA INA INA INA MIL-STP-100C MA MIL-STD-188-186 MIL STD-188-116 WACSEM SISS

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	TEC Incorporated	Tektronia	Research Inc. Teleray Dre	Teletype Corp	Texas Instruments	A9 Texas lestraments	Trines (acorporated	Want cabo ato in cosc	*
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includes one floppy drac drive)	Model 78	4051 \$7500 to \$8600	4941 INA	4075 50F0 \$3560	911 INA	914A INA	Plus 78 Model 8752 with 8634 keyboard	PCS - Option 604 drift di ve included :	
memory to 64K bytes		S7500 to \$8600 Graphics	,	Expandable memory	1	Memory expansion		· 	• 1
		ļ			1	te 32K bytes	F	→	
	Yes	Yes	Yes	Yes	Yes	· Yes	Yes	TR	٠,,
	Ym	Yes	Optional	No	Yes	Yes	Yn	tn.	**
	INA Vas	No	Optional	Yes .	Yes	Yes	Yn	194	••
	Yes	Yes	Optional	No	ļ Yes	INA	***	Yes	••
	Yes	Yes	Optional	Yes	Yes	Yes	Yes	Yes	***
	INA INA	No Yes	INA INA	INA Yes	INA (NA	, INA Yes	INA INA	INA Yes	4
	Yes	No	Optional	· Yes	Yn.	INA INA	Yes	T es No	7.0
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	Yes	No No	l.	! Yes	No No	No.	No ASCII	No.	128 No
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	. Yes INA	INA INA	Yes Two	Optional Two	Yes Two	Yes Two	Y es Two	' INA INA	Yes Tom
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	Yes Yes	INA INA	Yes Yes	Yes INA	INA Yes	INA Ves	INA Yes		Yes.
। भ	Yes 12'' diagonal	8" x 6"	Yes 12" diagonal	INA 13" diagonal	Yes 12' diagonal	Yes 14 diagonal	Yes 15 diagonal	IRA IRA	· Yes . 15' deags
,	Ym	INA	INA	INA	INA	INA	Yes	INA	INA
	None	None	None	None	None	Green phosphor	White green optional	New	None
	I INA	INA	Key and program	Key	Key	Key and program	Key and program	Key and program	Key
)	Birnking underline blinking block	INA	INA	Reverse video	Blinking	Underline	Blink or non blink	INA	INA
	INA	INA	Yes	INA	INA	Yes	Yes	i t a	IRA
i.	8 x 10	INA	INA	7 x 9	5 x 7	7 x \$	5 x 7	IRA	10 + 6
	, CRT	INA	Lights	I INA	Lights	Line on CRT	CRT for will bests	INA	IRA
		1							- 144
II 	INA P.A	INA	INA	60 times/second	50 or 60 times/second	INA	60 Hertz	- INA	60 hann
	P.4 Two pages	INA INA	INA 3840 characters,	INA 72 lines, 80 characters per line	INA	INA	INA 2K to 4K	IRA IMA	P4
r	+ — - · · · · · ·		3840 characters, 11360 characters optional	eu criaracters per line			* =	1	
	Yes	INA	Yes	INA	INA	INA		1	T
ļk	Yes Yes	INA	Yes	INA	INA	INA INA	INA INA	IRA IBA	INA
l ≱	Yes	Yes	Yes	Yes	Y 85	INA	Yes	Yes	INA
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ı	Yes	Yes	Yes	Yes	Yes	INA	Yes	Yes	INA
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ı	Yes	Yes Yes	Yes	YB.	Yes	Yes	Yes	INA	Yes
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	Yes	INA	Yes	Yes	Yes	Yes	Yes	INA	IMA
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	INA	INA	INA	INA	INA	INA	INA	INA INA	MA.
	ge 332 c		B6 272 C	95 122	INA	1			
jt leep	RS-232-C Current loop, TTL	IEEE 488-1975 GP18 RS-232 aption 81	RS-232-C current loop optional	RS-232 20/60ma current loop	INA	RS-232-C optional	INA		RS-232 C RS-422/44
,	1	1		(,		,	1	[
) bits/second	50 to 9600 Boud	118 to 2006 Bood	50, 75, 110, 134.5, 150, 300, 800,	110, 150, 300, 600, 1200,	INA	Selectable to	Selectable from 300 to 19,200 hps	1	Up to 19.2
	1	t .	1200, 1806, 2000, 2400, 3600, 7200, 9000, 19,200 Boud	2400, 4800 hits per second		9680 Bord	ļ	(· ·	
	1	1		<u> </u>		l	1	l	
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	Yes Yes	INA INA	Yes Yes	INA INA	INA	INA		1	INA INA
I	Yes	INA	Yes	INA	INA	INA	INA	IRA	INA
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	Research Inc. Teleray Div	Teletype Corp	Texas instruments	Texas instruments	Trivex Incorporated	Wang Laboratore, Inc	Lenter	James .
	4041	4025-50F0	911	914A	Plus 78 Model 8752 mrth 8634 kryboard	PCS II Option 60A disk direc actuded	ZMS 18 available or included	2 86 5 50
1600	INA	\$3560	INA	INA	INA	194	* (NA	:NA
	1	Expandable memory		Memory expansion to 32K bytes				
	 	· · · ·		10 32 K BY (E)			•	•
	Yes	Yes	Yes	Yes	Yes	Ym	†n	10.
	Optional	No		Yes	Yes	Yes	Yes	% c
	Optional Optional	Yes	Yes	Yes INA	Yes Yes	INA V	TH.	***
	Options	No	Yes	140	**	Yes	741	***
	Optional	Yes		Yes	Yes	Yes	† Th	••
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	Optional	Yes Yes	Yes	INA	Yes	Yes Na	184 Yes	Tes function kess No
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	Yes	Yes	INA	INA	Yes	INA	INA	INA
	INA	128 ASCII	128 ASCII	INA	96 ASCII	*	128	96 ASCII
	No	Yes	No	No	No .	No	40	40
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	Yes	Yes	INA	INA	INA	IMA	Yes	Yes
	Yes	INA	Yes	Yes	Yes	INA	Yes	Yes
	12" diagonal	13" diagonal INA	12" diagonal INA	14" dragonal (NA	15" élagonal Yes	INA INA	15 diagonal :	12 diagonai
	None	None	Nane	Green phosphar	White, green optional	None	INA None	INA None
					i I		l	
	Key and program	Key	Key	Key and program		Key and program	Key	Key
	INA	Reverse video	Blinking	Underline	Blink or non-blink	INA	INA	INA
	Yes	INA	INA	Yes	Yes	LINA	INA	INA
	INA	7 x 9	5 x 7	7 x 9	5 . 7	INA	10 x 0	7 a 9
	Lights	INA	Legitis	Line on CAT	CRT for self tests	; IMA	INA	36 m
			E.p.ru	2	1	1 100	'**	25th line on CAT
	INA	60 times/second	50 or 60 times/second	INA	60 Hertz	INA	68 helds second	60 fields second
	INA	INA	INA	INA	INA	IRA	P4	74
	3840 characters, 11360 characters optional	72 lines, 80 characters per line	INA	INA	2K 10 4X	16A	IMA	4K to 16K (46 lines to 199 lines
	1				 	 		140 1045 10 193 11115
	Ym	INA	INA	INA	INA	IRA	INA	Yes
	Yes	INA Yes	INA Yes	INA INA	INA Į Yes	HEA Yes	INA	Yes
	Yes	Yes	INA	INA	INA	Yes	INA INA	Yes Yes
	Yes	Yes	INA	Yes	Yes	Yes	INA	Yes
	INA	INA	INA	INA	INA	MA	INA	INA
	Yes	Yes	Yes	INA	Yes	Yes	INA	INA
	Yes INA	Yes INA	INA Yes	INA Yes	Yes	Yes	INA	Yes
	Yes	Yes	Yes	Yes	Yes	IMA	Yes Yes	Yes Yes
	Yes	INA	INA	Yes	Yes	INA	Yes	Yes
	INA	INA	INA	INA	INA	INA	INA	Yes
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	INA	Yes	INA	INA	INA	INA	AK'	INA
	INA	Up or down	INA	INA	: IMA	INA		up at dawn
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	Yes	INA INA	INA	INA INA	INA INA	INA INA		INA INA
	INA	INA	INA	INA	INA	INA	1	INA
175 GP18 on 81	RS-232-C surrent loop optional	RS-232 20/66ma current loop	INA	RS-232 C optional	INA	INA		RS-232-C RS-422/449 optional
								
l Bowl	58, 75, 110, 134.5, 150, 300, 660, 1200, 1000, 2000, 2400, 3600, 7200, 2000, 19,200 Soud	118, 158, 366, 660, 1200, 2400, 4800 bits per second	INA	Selectable to 9600 Raud	Selectable from 300 to 19,200 hps		12	18, 150, 300, 1200, 1 1400, 4600, 9000 BPS Histoble
	\	V	INA	INA		IMA	IRA .	Ym
	Yes	Yes INA	INA	INA	INA INA	INA		Yes IRA
	Yes	INA	INA	INA	INA	IMA	IRA (IRA
	Yes	INA	IRA	INA	INA	INA	1	INA
	Yes	INA	INA INA	IRA Yes	INA	IMA IMA		IRA INA
	Optional	INA	IMA	INA	Yes	INA		
	IMA	*NA	''''	177	INA	1700	····	MA
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	confront key program on acth	100		Key and program	***	teraci par	Ray and propier	1.,	tn.
33	type blinking underline	18g.A		Reverse image black	reverse video	Brock	i N.A.	Sinsing under the	44
-	reverse video etc.								**
14	addressable	198.6		Ym	Yes.	Ten	7 05	18g A	**
35	Dot Matrix for characters	13 . 9		9 = 17	7 ± 11	51.	5.1	1.1	***
,,	8 x 10 18 x 16 etc.			•		••	,	• •	• •
36	Status displays (lights or line on CRT	184A		CRT screen on command and lights	Lights	1 % A	Laphy and CR*	44	INA
37	Fischer free				•		•		
30	retrosh screen data rate	INA		Passerline frequency	68 frames, second	68 Hertz	60 fields acond	60 Hert:	144
39	photohor type (e.g. P4)	INA		P4	IMA	INA.	24	24	19.6
	Memory sare for deplay	(NA		IRA	1929 characters standard	INA	INA	(NA	INA.
. 44	and with the second	170,70		198	up to 5760 aptional	.44	'75		
F	Compass and Edit Features			-		•	• •	•	•
a1	Erzen to end of line	INA		INA	Ym	Yes.	- INA	INA	1 % A
42	Erms to end of same	INA		I INA	INA	7m	TH	IN A	INA
43	Character delete	INA		. Yes	Yes	(NA	Yes	Ym	**
44	L use delete	INA		Yes	Yes	l Yes	Yes	1m	16
45	Clear screen	INA		Yes	Ym	Yes	184	tec	18
46	Character overwrite	INA		INA	INA	INA	INA	19.4	**
47	Character insert	INA		Yes	Yes	INA	Yes	Yes	Tes
48	Line weer!	INA		Yes	Yes	INA	Yes	tes	Yes
45	Backspace	INA		INA	No	INA	INA	Yes	INA
50	Forward tab	INA			Yn	Yes			
51	Forwers tab Backword tab	INA		Ye		INA	Yes	Tes INA	INA INA
		INA		IRA	No.		Yes		
52	Adjust space and line automatically when characters, words, or sentences are				Yn	114.4	1% A	INA	I Ng A
	added or deleted (word wrap)				1				
53	Automatically change paging when	INA		INA	≀MA	INA	, INA	IN A	INA
1	additions or deletions are made						İ		
54	Clear unpretected data	INA		Yes	INA	INA	INA	INA	INA
55	Scroll up or down	INA		Scroll up	tip or down	INA	INA	INA	Up at down
56	Audible storm for end of line	INA		INA	INA	INA	INA	t % A	INA
57	Audible alarm for end of page	INA		INA	INA	INA	INA	INA	INA
58	Automatic paging	INA		INA	INA	INA	INA	INA	, INA
59	Protected fields (programmable)	INA		Yes	Yes	Yes	Yes	INA	Yes
50	Cursos control from keyboard	INA		Yes	Yes	Yes	Yes	Yes	Yes
61	Line number disalay	INA		INA	INA	INA	INA	INA	INA
62	Column number display	INA		INA	IRA	INA	INA	INA	INA
63	Word yearch for delets or replace	INA		INA	ARI	INA	INA	INA	INA
64	Next page	INA		INA	INA	INA	INA	Yes	· INA
65	Previous page	INA		INA	INA	INA	INA	Yes	INA
66		INA		INA	INA	INA	INA	INA	, INA
66	First page	INA		INA	INA	INA	INA	INA	·-
66		INA		INA RS-232-C	INA	RS 232 C	RS 232 C 20ma current loop aptional MIL STD 188C MIL STD 188C 100	RS 232 MIL STD 188C aptional MIL STD 188 100 aptional	RS 237 C 29ma current loog
	First page Communication Interface and Control						RS 232 C 20ma current loop optional MIL STD 188C	RS 232 MIL STD 188C aptional	RS 237 C
67 60	First page Communication Interface and Control Type interface	INA		RS 232 C 75. 110. 200, 300, 600, 1200. 1800. 2400, 4800, 7200.	INA	RS 232 C	RS 232 C 20ma current loop aptional MIL STD 188C MIL STD 188C 100	RS 232 MIL STO 188C optional MIL STO 188 100 optional MIL STO 188 114 optional 110, 150, 300, 1200, 2400	RS 237 C 20ma current loop
67 60 69	First page Communication Interface and Control Type interface Transmission rates Transmission modes	INA		RS 232 C 75. 110. 200, 300, 600, 1200, 1800, 2400, 4800, 7200, 9600 Boul	INA 110 to 2400 8epd	RS 232 C 75 to 19,200 bps, switch selectable	RS 232 C 20ma current loop optional MIL STO 188C MIL STO 188C 100 110 150, 300, 600, 1200 2400, 4800, 9500 8aud	RS 7.32 MIL STO 188C optional MIL STO 188 100 optional MIL STO 188 110 optional MIL STO 189 110 optional 110 150 300 1200 2400 4800 9600 Baud	RS 232 C 20ma current loog 110 to 9500 bits second
67 68 69 70	First page Communication Interface and Control Type interface Transmission rates Transmission modes character at a time	INA INA INA		RS 232 C 75. 110. 200, 300, 600, 1200, 1800, 2400, 4800, 7200, 9600 Bead	INA 110 to 2400 Sepud	RS 232 C 75 to 19,200 bps, switch selectable	RS 232 C 20ma current loop optional MIL STD 188C MIL STD 188C 100 110 150, 300, 600, 1200, 2400, 4800, 9600 8aud Yes	RS 232 MIL STO 188C optional MIL STO 188 100 optional MIL STO 188 114 optional 110 150 300 1200 2400 4800, 9600 Baud	RS 237 C 20ma current loop 110 to 9600 bits second
67 68 69 70 71	First page Communication Interface and Control Type interface Transmission rates Transmission modes Character at a time time at a time	INA INA INA INA	-	RS 232 C 75. 110, 200, 300, 600, 1200, 1800, 2400, 4800, 7200, 9800 Bend INA Yes	INA 110 to 2400 Saud Yes Yes	RS 232 C 75 to 19,200 bps, switch selectable Yes Optional	RS 232 C 20ma current loop optional MIL STD 188C MIL STD 188C 100 110 150, 300, 600, 1200, 2400, 4800, 9600 8aue Yes	RS 232 MIL STD 188C aptronal MIL STD 188 100 optronal MIL STD 188 110 optronal 110, 150, 300, 1200, 2400 4800, 9600 Baud	RS 237 C 20ma current loop 110 to 9600 bits second Yes Yes
50 50 70 71 72	First page Communication Interface and Control Type interface Transmission rates Transmission modes character at a time full screen at a time	INA INA INA INA	-	RS 232 C 75. 110, 200, 300, 600, 1200, 1800, 2400, 4800, 7200, 9600 Bead INA Yes Yes	INA 110 to 2400 Saud Yes Yes Yes	RS 232 C 75 to 19,200 bps, switch selectable Yes Optional	RS 232 C 20ma current loop optional MIL STD 188C MIL STD 188C 100 110 150, 300, 606, 1200, 2400, 4800, 9600 8aud Yes Yes	RS 232 MIL STO 188C optional MIL STO 188 100 optional MIL STO 188 114 optional 110 150 300 1200 2400 4800, 9600 Baud INA INA	RS 237 C 20ma current loog 110 to 9600 bits second Yes Yes
59 70 71 72 73	First page Communication Interface and Control Type interface Transmission rates Transmission modes character at a time line at a time full screen at a time partial screen at a time	INA INA INA INA INA		RS 232 C 75, 110, 200, 300, 600, 1200, 1800, 2400, 4800, 7200, 9600 Beard INA Yes INA	INA 110 to 2400 Saud Yes Yes INA	RS 232 C 75 to 19,200 bps, switch selectable Yes Optional Optional	RS 232 C 20ma current loop optional MIL STD 188C MIL STD 188C 100 110 150, 300, 600, 1200 2400, 4800, 9600 8aud Yes Yes Yes	RS 7.32 MIL STO 188C optional MIL STO 188 100 optional MIL STO 188 110 optional MIL STO 188 100 2400 4800 9600 Baud INA INA INA	RS 232 C 20ma current loog 110 to 9500 bits second Yes Yes Yes INA
59 70 71 72 73 74	First page Communication Interface and Control Type interface Transmission rates Transmission modes character at a time line at a time full screen at a time multiple pages at a time multiple pages at a time	INA INA INA INA INA INA		RS 232 C 75. 110, 200, 300, 600, 1200, 1800, 2600, 4800, 7200, 9600 Bood INA Yes INA INA	INA 110 to 2400 Sepud Yes Yes INA	RS 232 C 75 to 19,200 bps, switch selectable Yes Optional INA	RS 232 C 20ma current loop optional MIL STD 188C MIL STD 188C 100 110 150, 300, 600, 1200, 2400, 4800, 9600 8aud Yes Yes Yes INA	RS 232 MIL STO 188C optional MIL STO 188 100 optional MIL STO 188 1100 optional MIL STO 188 114 optional 110 150 300 1200 2400 4800, 9600 Saud INA INA INA INA	RS 237 C 20ma current loop 110 to 9600 bits second Yes Yes INA
59 70 71 72 73 74 75	First page Communication Interface and Control Type interface Transmission rates Transmission modes Character at a time time at a time full screen at a time partial screen at a time multiple pages at a time polling	INA INA INA INA INA INA		RS 232 C 75. 110. 200, 300, 600, 1200, 1800, 2400, 4800, 7200, 9600 Bead INA Yes Yes INA INA INA	INA 110 to 2400 Saud Yes Yes INA Optional	RS 232 C 75 to 19,200 bps. pentch selectable Yes Optional INA INA	RS 232 C 20ma current loop optional MIL STD 188C MIL STD 188C 100 110 150, 300, 600, 1200, 2400, 4800, 9600 8aud Yes Yes Yes Yes INA Optional	RS 232 MIL STO 188C optional MIL STO 188 100 optional MIL STO 188 1100 optional MIL STO 188 114 optional IN 110 150 300 1200 2400 4800, 9600 Baud INA INA INA INA INA	RS 237 C 20ma current loop 110 to 9600 bits second Yes Yes INA Yes Yes
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) 2400	110 to 9600 bits/second	50 to 9600 Baud	110 to 2400 Baud	50, 75, 110, 134 5, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 7200, 9600, 19,200 Baud	110, 150, 300, 600, 1200, 2400, 4800 bits per second	INA	Selectable to 9600 Baud	Selectable from 300 to 19,288 has	
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	60 lbs.	INA	65 lbs.	43 lbs.	110 lbs.	INA	78 Hbs.	, ^{74 lbs}	62 lbs
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APPENDIX B KEYBO

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	current loop optional 56, 75, 118, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 7200, 9600, 19.200, 8604	20 60ma current loop 110, 150, 300, 600, 1200 2400, 4800 bits per second	INA	Selectable 9600 Baud	: Selectable from 300 to 19,260 hps	INA	RS-422 448 aptional	RS 422 449 optional 110 150 300 1200 1800 2400 4800 9500 RPS selectable
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	current loop optional 56, 75, 110, 134,5, 150, 300, 600, 1206, 1800, 2000, 2400, 3600, 7200, 9600, 19, 200, 8aud Ves. Yes. Yes. Yes. Uptional	20 80ms current toop 110, 150, 300, 600, 1200, 2400, 4800, bits per calend Yes INA INA INA INA	INA INA INA INA INA INA	Selectable 19600 Baud INA INA INA INA INA INA INA	Selectable from 300 to 19.200 haps INA INA INA INA INA INA INA INA INA IN	INA INA INA INA INA	RS-422 448 optional We to 19.2 Kbps INA INA INA INA INA INA	RS 422 649 optional 110 150 380 1290 1806 2400 4400 9600 8PS selectable Yes INA INA INA INA
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	current loop optional 56, 75, 110, 134,5, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 7200, 9600, 19, 200, 8aud Ves Yes Yes Optional INA	20 80ms current toop 110, 150, 300, 600, 1200, 2400, 4800, bits per second. Yes INA INA INA INA INA	INA INA INA INA INA INA	Selectable 9600 Baud INA INA INA INA INA INA INA INA INA	Selectable from 300 to 19.200 haps. INA INA INA INA INA INA INA INA	INA INA INA INA INA INA INA	RS-422 448 optional No to 19.2 Kbps INA INA INA INA INA INA INA IN	RS 422 649 optional 110 150 380 1290 1800 2400 4600 9600 BPS selectable Yes INA INA INA INA INA
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	21" 15.5" 13.5" 43.1%s. 1NA 1NA 1NA INA INA	20 80ms current toop 110, 150, 300, 600, 1200, 2400, 4400, bits per recond Yes INA INA INA INA INA INA INA INA INA INA	INA INA INA INA INA INA INA INA INA INA	Selectable 19600 Baud INA INA INA INA INA INA INA INA INA IN	Selectable from 300 to 19.200 haps. INA INA INA INA INA Yes INA 28.5" 16" 17.5" 74 lbs. 115/220 IMA 50 60 Hertz IMA 200	INA INA INA INA INA INA INA INA INA INA	RS-422 448 optional We to 19.2 Kbps INA INA INA INA INA INA INA INA INA IN	110 150 380 1290 1800 2400 4400 9500 8PS selectable Yes INA INA INA INA INA INA INA INA INA INA
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APPENDIX B KEYBOARD DISPLAY TEHRTINAL (KDT) CHARACTERISTICS AND FOUIPMENT

 $\label{eq:appendix} \textbf{APPENDIX} \ \textbf{C}$ $\textbf{MAGNETIC} \ \textbf{DEVICE} \ \textbf{CHARACTERISTICS} \ \textbf{AND} \ \textbf{EQUIPMENTS}$

\Box	Hem Number		02	0?			ж	· · · · · · · · · · · · · · · · · · ·
12	Magnetic Type Drive	Fraggy Disk	Tape Cassette	Floppy Disk	Finger Cur	Frappy Disk	Finger Dise	Flagge 2 in
H+	Manufacturer	American Microsystem Inc	Interdyne	Business System Technology Inc	- Data film is size Communication	Perkin Eimer Data Systems, Wangca	Person Elmy Gary St. 1995 Margo	Dara Equipment Con
\mapsto	Madel Number	MDC 120	3801	8ST 41	DT: V	Model 82	. Made 8102. Fage.	81.3
++			\$1950			- INA		\1
	Cost Range	\$4700 	31990	- · · · · · · · · · · · · · · · · · · ·	- INA 	• 11	, '"	
6	Drives per Unit Storage capacity per drive	756,756 bytes	540 000 bytes	242,944 characters	300m	124 7K bytes double density optimal double sided optional	256 256 n	256 256 \$ 5 1 5 272 125 121 12 5 1 winds
٠,	Data format on medium	IBM 3740	ANSI phase encoded	IBM 3741 42	37 types in 12 westure a 128 characters	Modified IBM type	Trace through sinBM 3142 illimpatitive	industry classifiand
1.	Number of drives	TWO	one	One (two optional)	Two upin has promat	One INA	Ta - 1N4	140 360 RPM
91	Drive speed	iNΔ	12 ips read write 40 ips search 120 ips forward or backward	360 RPM	INA	13.4		
10	Data denuty on medium	INA	800 bp	: 3268 BPI	INA	INA	3200 BPI (Hude track, 48 tracks per inch.	-44
	Operational Characteristics				·····			
11	Maximum access time for data	INA	INA	INA	260 million: -ai	INA	14.0	483 mini-worlds
12	Average access time for data	INA	INA	INA	200 ministra indic	370 militseconds	194	483 microscondi. 10K hytes assend byte mid-
13	Transfer rates	1NA	9600 BPS	Reads 3000 Records min Writes 2000 records min	INA	125 000 bps FM encoding 250 000 bps double density	154	Skiwing welcook 12 bit mid-
14	Error rate	INA	: - 1 to 10 hard	INA	IN A	1 in 10 hard 1 in 10 soft	(% A	P _b Δ
1 '								INA
15	Protocol for drive control and data transfer	FDOS II	ASCII Remote 40 ips search	INA	INA	INA	- INA +=	
16	Self Test Mode	Yes	No	INA	INA	INA		1 % A
П	Operator Controls and Indicators		1			T.		
17	Power on off switch	Yes	Yes	No	' Yes	I N A	Yes INA	INA INA
18	Operating mode switch	No	Yes	Yes	1 Yes	INA	194	INA
19	Keylock switch (controls power or operating controls)	No	No	No		INA	.''' •	-
	Size of Magnetic Medium to be used by Magnetic Device		INA		5.1.4 diskerts	! 5 25 diskette	514 diskrite	3
20	Diameter	5 1.4" Diskette (N/A)		5:1/4" N A	N A	N A	N A	N.A.
[]	Thickness	(M/A)		1 1 1	1	NA	NΑ	% A
22	Length	(N/A)		N A	N A	N A	N A	¥ 4
23	Width	(N/A)	1	N-A	N A	<u> </u>	· •	
	Data Input/Output Interface and Control					I.		
	Type interface	i				i	INA	·NA
24 25	RS 232C	Yes INA	Yes	INA	RS 232	INA		
28	NTDS slow NTDS fast	INA	No No					
27	ANEW	INA	No					
28	MIL STO 188 C	INA	No			ļ		
29	MHL STD-188-174	INA	No		}	1		
30	MIL STD-188-100	I INA	No				1	
31	Current Loop	INA	Yes	Ì	 .	1		
32	Boud rate(s)	INA	110; 300, 600; 1200; 2400; 4800; 9600; 19200;		110, 300-1200-2400, 4800, 9600 Baud, switch or program selectable		l .	
33	Military Specification Conformance	INA	INA	INA	INA	INA	INA	INA
Т	Physical Dimensions	INA	 	 	 	1	INA	INA
34	Length	1	13"	INA	23 5	7 95"		
35	Width		11-1/2"	INA	17 25"	5.75"		
36	Height	1	18"	INA	11"	3.25"		\
37	Weight	<u>L</u>	20 lbs.	90 lbs.	71 75 lbs	INA	<u> </u>	
	Power Requirements	LNA			11011.104	INA	INA	INA
*	Voltage (sc)		115-10%	230V	115V -10%	INA		
39	Current Frequency	ì	INA 50/60 Hertz	2.5 Amps	60 Hertz	INA		
-	· · • • • • • • • • • • • • • • • • • •		Sw ou ner u	1774		1		
**			One	INA	INA	INA		
41	Phoms	ĺ	1		INA	15	+	INA
- 1 - 1	Phons Wets	184	125	500		Lina	INA	
41	Phones Wests Environmental	INA	125	600		INA	INA	
41 42	Phons Wetts Emirpamystal Operating	INA			90' F maximum at	INA	INA	
41	Phones Wests Environmental	INA	0 to 50 day C 20 to 95%	19 to 35 C	90° F maximum at 80%	INA	INA	
41 42 43 45	Phone Wets Environmental Operating ambient temperature	INA	0 to 50 deg C 20 to 95%	10° to 35°C	80%	INA	INA	
1 4 4 4 4 4	Phone Wetts Erreirennestal Operating ambient temperature hamidity (non-condemonal) Storage and shipping comparature temperature	INA	0 to 50 deg C 20 to 95%	10 to 35 C INA	80%	INA	INA	
4 4 4 4 4	Phones Wetts Environmental Operating ambient temperature homidity (non-condensing) Storage and shipping	INA	0 to 50 deg C 20 to 95%	19 to 35 C	80%	INA	INA	

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N/A - NOT APPLICABLE INA INFORMATION NOT AVAILABLE

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1924	Perkin Eimer Data Systems, Wrange.	Digital Equipment (15)	More gara	. _v	W See.	Territoria	Pela i Elme Data Sutemu Mange	National Michigany (1997)
	Mode 87 Dual Empu.	ня <i>тв</i>	Beta	· - M. (1)		154.70 0.4 3 4	Supr Sur +1	
	NA .	• • • • • • • • • • • • • • • • • • •		N=	•			- \$6 (4.207), an Shirik
	• •	• 34	34		· ` ` ` ` ` ` ` ` ` ` ` ` ` ` ` ` ` ` `	. ^4	***	\$2.194
r	756-256 by tri	256-256-8 bir byte (1.128-128-12) 12 bir wirdi	17 Survey	Weganis	11.5 W	288-200 (naracte)	100 regulates per disci 20 regulations	180 (00 e ./w.
	Track formatics (BM 3740 compatible	Endingtry Handard	J. Nachalter	4M - 45	Modified Englishes Milduighton		4 A	Ye abo in a tit
	1 w. MA	160 RPM	7964 RPM	Sept HAM - 2430 HAM		Two. TS paread with war handle ase.	0 ≒ - % a	30 ox rad write are wallt
	3200 BPI - Criside track - 48 tracks per inch-	INA	5636 605 (c)	N.4	fewind and fail field. 6490 bits not	48 ips rewind 780 bits 124	\$406 5 tylinch	800 bits not
	•							
	184	-NA	57 m i wr. d	\ 4	-NA	:NA	N 4	V4
	\ A	483 million and	42 of Priority of	the week and	NA		13 Serverie	
	iNA.	*OK bytes secure byte mid-	Fig8 WHy	100K 5.5 Loc 1500 RPM	197 000 6 th per wall of		N4	
		58 words second 12 bit mode		370K 5155 WE 2400 RPM				
	INA	INA	The 10 to 50 to the groups of 10 10 to 50 to the operation	1 10 consequentable 1 10 consequentable	1 - 10		·NA	
•	(NA	INA.	INA	54	INA		184	
							•	
•	· INA	INA	/NA	. NA		· · · · · · · · · · · · · · · · · · ·		· .
•								
	Yes	INA	1N-A	7.0	Ye.	· Yes	174	100
	IN A	INA	NA.		Yes	14:		4.61
	INA	INA	rsa.		INA	15A		NA .
	•	,		•			/54	
	111 41 4							:VA
	5 ° 4 i diskettr N. A	8' N. A.	154	14 194	INA ANSI Std. Data Cartridge	Computer grade Philips cassette		3M type 00 180A
	NA .	N A	INA INA	N A	H431 310 Date co. (specified by ANSI X381 638		Data Califolde
	N A	N A	INA	N A				
				•		.		
	-NA	INA	INA	IN A	INA	RS 232 C	15.4	RS 232 C
	1					1		
						!		1
						1		
								50 to 19 2K Baud
						1200 Baud		30 10 13 2 K Dade
	— +	INA	INA	iNA	INA	INA	INA	.NA
								
•	INA	INA	28			20.0	27	10 .
	i I			27 19	13	20 9 19 6"	19	17
			7	8.75	7	11"	734	514
			100 165	120 lbs	40 lbs	41 lbs	INA	22 lbs
	INA	INA						
			100 115	115 220 - 10%	115 220	120 220 240	+NA	115 230
	!			INA	INA	1 Amp 05 Amp	INA	INA
1		:	60 Hertz	59 5 to 60 5 Hertz or	60 Hertz (50 Hz optional)	60 Hertz 50 Hertz	INA	50.60 Hertz
ı				49 5 to 50 5 Hertz	One	INA INA	INA	INA
			350 (max)	INA	150	INA INA	400	INA
	INA	INA				!	INA	
,		1	15 to 41 P		6 0 45 C	10 C to 40 C (forced and		0 C to 50 C
'			15 to 41 C 10% to 80%	12 to 40 C 10% to 80%	5 C to 45 C	20% to 80%		20% to 80%
,				10 3 10 80 7	,			
	ì	}	INA	INA	- 26°C to +60°C	INA		INA
		i	INA	INA	5's to 95's	INA		INA
$\perp \perp$			INA	INA	40.000 feet	INA		INA

APPENDIX C MAGNETIC DEVICE CHARACTERISTICS AND EQUIPMENTS 79/80

AD-A005 306

NAVAL OCEAN SYSTEMS CENTER SAN DIEGO CA
NAVAL OUTGOING MESSAGE PROCESSING, A STUDY OF MESSAGE GENERATIO--ETC(U)
DEC 79

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APPENDIX D
TYPEWRITER TERMINAL CHARACTERISTICS
AND EQUIPMENTS

-1	Item Number	01	02	03	04	05
2	Menufecturer	A. B. Dick Co.	Agile	Burroughs, Redectron	E-Systems, ECI Division	IBM, Office Products D:
3		MAGNA I	Model A1	Repactor 1, Series Q	T-1148	Memory 100 Typewrite Model 5661
4		\$9532.50	INA	INA	INA	\$4655.
-	Keyboard	INA			!	
5		· [Yes	INA	No	No
6	1 ' ' ' '	1	Yes	INA	No	No
7	Repeat function	,	Yes	Yes	Yes	Yes
8	1	1	Yes	Yes	INA	INA
9	Index key	,	INA	Yes	No	Yes
10	 	<u> </u>	INA	INA	INA	Optional
- 1	Print and Print Mechanism					†
11	1 '	INA	No	INA	INA	No
12	ſ	INA	No	No	Yes	No
13	1	INA	No Was	No	No	No
14	1 '	INA	Yes	Yes	No	No
15		INA (EOO + weeds/monace)	Yes	Yes	Yes	Yes
16	1	INA (500 + words/minute)	30 (45 and 55 optional)	40	120	15.5 cps
17		94 INA	96	96	INA	86
18	,	INA INA	INA Yes	INA	INA No	No V
19 20	1 ' ' ' '	INA	Yes	Yes	No Ontignal	Yes V
21		INA	INA	INA	Optional INA	Yes Yes
22	1	10 and 12	10 or 12	10.28 and 12	INA 10	Yes 10 and 12
23		INA	6 or 8	10.28 and 12	16	IV and 12
24	1	INA	132 (10 pitch); 158 (12 pitch)	132 (10.28 pitch); 158 (12 pitch)	-	125 (10 pitch); 150 (12
25		INA	about 14"	15" (10.28 pitch); 158 (12 pitch)	INA	15-1/2"
26	1	INA	256 characters	INA	16,000 characters	4000 characters
27	1	Yes	INA	INA	INA	Yes
\neg	Communication Electrical Interface	INA			1	
28		1	600 Baud option	INA	50, 75, 100, 110, 150, 200, 300, 600,	INA
ا	1	1	Out Denn option,	I IMM	1200, 2400 selectable	INA
29	Туре	1	RS-232	INA	CCITT V28 (±6V low level)	INA
ı J	1	1	1	Į J	current loop (60V, 60 ma)	(
ı J	ı	1	1	1	High level (±80V, 20 ma)	(
-	 		 '			
30	Compose and Edit Feetures Backspace	INA	INA	Yes	[Yes
31	Audible alarm for end of line	INA	INA	Yes	Yes	Yes INA
32	Audible starm for end of page	INA	INA	INA	INA	INA
33	, , ,	INA	Yes	INA	INA	Yes
34	Size of memory for typed message	8000 characters	INA	INA	INA	100 pages storage
35		Yes	INA	INA	INA	INA
36	•	INA	INA	INA	Yes	Yes
37	Carrecting ribbon	INA	INA	INA	INA	Yes
38	Line insert	INA	INA	INA	Yes	Yes
39	Word wrap	Yes	INA	INA	INA	INA
40	Word search	Yes	INA	Optional	INA	INA
41	Character delete	INA	INA	INA	Yes	Yes
42		INA	INA	INA	Yes	Yes
43	1 -	INA	Yes	Yes	INA	INA
44		INA	Yes	Yes	Yes	Yes
45		Yes	INA	INA	Yes	INA
46	Military Specifications Conformance	INA	INA	INA	MIL-E-4158	INA
	ı	1	1	1	MIL-E-5400	í
	4	1	1	1	MIL-E-16400	1
()	1	1	1	1	MIL-STD-461	l .
	ı , , , , , , , , , , , , , , , , , , ,	1	1	1	MIL-STD-462	i
	<i>'</i>	1	1	1	NACSEM 5100	ſ
\vdash	Physical Dimensions	 				
47	(20-1/2"	21"	19-1/2"	23"	18"
48		23-7/8"	23-1/2"	21"	16"	26-3/4"
40		8-1/4"	32"	7-1/4"	9"	7-1/2"
50	Weight	45 lbs.	66 lbs.,	55 lbs.	50 lbs.	75 lbs.
ت		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	, , , , , , , , , , , , , , , , , , , 		T AVAILABLE	

N/A - NOT APPLICABLE INA - INFORMATION NOT AVAILABLE

	03	04	05	06	07	08
	Burroughs, Redactron	E-Systems, ECI Division	IBM, Office Products Division	TRANSACTION DATA SYSTEMS, INC.	Perkins-Elmer Data Systems, Terminal Division	Oume
	Redector 1, Series Q	T-1148	Memory 100 Typewriter, Model 5681	TRANSWRITER (add-on to IBM SELECTRIC)	Carousel 310	Sprint 5 KSR
	INA	INA	\$4655.	\$2495.	INA	\$2480.
				Same as IBM SELECTRIC		
	INA	No	No		V	Yes
	INA	No	No		Yes	No No
	Yes	Yes	Yes		INA	Yes
	Yes	INA	INA		INA	Yes
)	Yes	No	Yes		INA	INA
1	INA	INA	Optional		INA	INA
			Ортопат		INA	1142
				Same as IBM SELECTRIC		
}	INA	INA	No		Na	No
	No	Yes	No		No	No
	No	No	No		No	No
	Yes	No	No		No	Yes
	Yes	Yes	Yes		Yes	Yes
P	40	120	15.5 cps		40 cps peak	45 cps or 55 cps
i i	96	INA	86		96 ASCII	96
	INA	INA	No		INA	INA
	Yes	No	Yes		Yes	Yes
ŀ ∣	INA	Optional	Yes	'	Yes	Yes
	INA	INA	Yes		INA	INA
i i	10.28 and 12	10	10 and 12		10 and 12.5	10 or 12 or 15
	6 ;	6	INA		6 (8 optional)	6
pitch)	132 (10.28 pitch); 158 (12 pitch)	80	125 (10 pitch); 150 (12 pitch)		128	132 (10 pitch); 158 (12 pitch)
	15"	INA	15-1/2"		15-1/2"	14.65"
	INA	16,000 characters	4000 characters		INA	17 characters
	INA	INA	Yes		INA	Yes
,						
	INA	50, 75, 100, 110, 150, 200, 300, 600, 1200, 2400 selectable	INA	INA	110, 150, 300 Baud std., 1200 Baud optional	110, 150, 300, 600, 1200 Baud
	INA	CCITT V28 (±6V low level) current loop (60V, 60 ma)	INA	INA	RS-232-C	RS-232-C or 20 ma current loop
		High level (±80V, 20 ma)				
					INA	
İ	Yes	Yes	Yes	Same as IBM SELECTRIC		Yes
	INA	INA	INA			INA
ľ	INA	INA	INA			INA
	INA	INA	Yes			INA
1	INA	INA	100 pages storage	20 pages per tape cassette		INA
	INA	INA	INA	Yes		INA
	INA	Yes	Yes	Yes		INA
	INA	INA	Yes	IBM SELECTRIC Capability		INA
i	INA	Yes	Yes	Yes		INA
	INA	INA	INA	INA		INA
}	Optional	INA	INA	INA		INA
, I	INA	Yes	Yes	Yes		INA
	INA	Yes	Yes	Yas		INA
	Yes	INA	INA	IBM SELECTRIC Capability		Yes
	Yes	Yes	Yes	IBM SELECTRIC Capability		Yes
	INA	Yes	INA	INA	Yes	Yes
	INA	MIL-E-4158	INA	INA	INA	INA
		MIL-E-5400		ļ		·
		MIL-E-16400			}	1
]		MIL-STD-461	İ	i		1
		MIL-STD-462				
		NACSEM 5100				ì
. !	19-1/2"	23"	10"	Adds several inches to depth	24"	25.3"
i	21"	18"	28-3/4"	of IBM SELECTRIC	28"	23.5"
	7-1/4"	9 "	7-1/2"		9"	7. 625⁴
	55 lbs.	50 lbs.	75 lbs.	INA	INA	49.5 lbs.

APPENDIX D - TYPEWRITER TERMINAL CHARACTERISTICS AND EQUIPMENTS
83/84

APPENDIX E PRINTER CHARACTERISTICS AND EQUIPMENTS

11	Item number	01	02	03	04	05	06	1
2	Manufacturer	AGILE	Data General Corp.	Data 100 Corp.	Recel-Milgo (ICC)	Perkin-Elmer Data Systems,	Teletype Corp	Qume
						Terminal Division	- confide dock	
3	Model number	A1R (Qume mechanism)	6043	4430 Whisper Quiet	40 + 20C	Carousel 310	4010-8F0D	Sprint 5 (
4	Cost Range	INA	INA	INA	INA	INA	\$8205	\$2140
	Print style							
5	Fully-formed characters	Yes	No	Yes	INA	Yes	Yes	Yes
6	Dot matrix OCR A font available	No INA	5 x 7	INA Yes	INA INA	No Yes	No	No INA
8	OCR 8 font available	INA	INA	Yes	INA	INA	INA	INA
9	Operator changeable	Yes	INA	INA	INA	Yes	INA	Yes
10	Variable pitch	Yes	No	INA	No	10 or 12.5	No	10, 12 er
	Print mechanism							
11	ink jet printer	No	INA	No	INA	No	No	No
12	Daisy wheel printer	Yes	No	No	INA	No	No	Yes
13	Impact printing	Yes	INA	INA	Yes	Yes	Yes	Yes
14	Characters printed per second Programmable impact of print hammer	30, 45 or 55 INA	INA	(300 lines per minute)	(180 lines per minute)	40 INA	3.7 (ines/sec. (80 characters/line)	45 (55 og Yes
15 16	Lines printed per inch	6 or 8	6	6	6	6 or 8	6 or 3	6
17	End of ribbon indicator or control	INA	INA	INA	No	INA	INA	Yes
18	Vertical line space	INA	INA	INA	INA	INA	INA	INA
	Paper Handling							
19	Maximum width of paper	14-7/8"	15"	16"	12-27/32"	15-1/2"	8-1/2"	14.65"
20	Friction feed	Yes	INA	No	Yes	Yes	Yes	Yes
21	Pin feed	Optional	INA	Yes	No	Optional	Optional	Yes
22 23	Vertical slew rate Paper thickness	INA I INA	INA	INA	INA	INA	INA	5 inches si
-3		INA	INA	INA	INA	INA	INA	INA
24	Programmable controls Horizontal tab to column number	Yes	INA	INA	INA	INA	INA	Yes
25	Vertical tab to line number	Yes				INA		Yes
26	Relative horizontal increment moves	1/120"				1/100" increments		1/120**
27	Relative vertical increment moves	1/48"				1/48" increments		1/48"
28	Non-escapement	INA		L	<u> </u>	INA		Yes
29	Self Test Mode	INA	INA	Yes	Yes	Yes	Yes	INA
	Operational features							
30	Cartridge ribbon	Yes	Yes	INA	INA	Yes	INA	Yes
31	Quiet operation (55 dBa max. noise level)	INA	INA	INA	INA	INA	INA	INA
32	Line-at-a-time printing	No Voc	No	Yes	Yes	No	Yes	No
34	Character-at-a-time printing Size of buffer memory	Yes 256 characters	Yes 40 characters	No INA	No 120 characters	Yes 12B characters	No 2 lines (80 char./line)	Yes 224 charac
\dashv	Panel controls for operation	INA	TO CHIEFACTERS	1170	. Eo Chaldelell	. To cubiar(g)		
35	Power on/off	""	INA	Yes	INA	Yes	INA	INA
36	Input rates selector		Yes	No	No	Yes	INA	Yes
37	Self test/operator		INA	Yes	No	INA	Yes	INA
	Electrical Interface							
38	Туре	RS-232	20 ma current loop RS-232-C	RS-232	INA	RS-232-C	R\$-232-C MIL-STD-188C	RS-232 C 20 ma curr
·					-		20/60 ma current loop optional	
39	Protocol	INA	INA	INA	INA	INA	INA	INA
40	Input data rates	600 Baud	110, 150 and 300	INA	INA	110, 150, 300 Baud Standard;	Up to 9600 Bits per second	110, 150, 1
**			,, anu 300			1200 Baud optional	· · · · · · · · · · · · · · · · · · ·	1200 Baud
┥	Physical dimensions				 	<u></u>		
41	Depth	INA	21"	28"	27.28"	24"	17-3/8"	18.8"
42		23-1/2"	27.5"	30"	20.375"	28"	17"	23.5"
	Width	23-1/2	l .		44 500	9"	6-1/2"	7.625"
43	Height	32" (on pedestal)	33.5" (on pedestal)	49-1/2" (on pedestal)	11.56"			44 **
43 44	Height Weight	32" (on pedestal) 61 lbs.	80 lbs.	290 lbs.	83 lbs	INA	67 lbs.	44 lbs.
- 1	Height	32" (on pedestal)	1				MIL-STD-188C	44 lbs.
44	Height Weight Military specifications conformance	32" (on pedestal) 61 lbs.	80 lbs.	290 lbs.	83 lbs	INA		
44	Height Weight Military specifications conformance Power requirements	32" (on pedestal) 61 lbs. INA	80 lbs.	290 lbs.	83 lbs	INA INA	MIL-STD-188C NACSEM 5100	INA
44 45 46	Height Weight Military specifications conformance Power requirements Voltage (ac)	32" (on pedestal) 61 lbs. INA	80 lbs. INA 120V	290 lbs. INA 115V	83 lbs 1NA 117V 10%	INA INA 120V Std, 240V optional	MIL-STD-188C NACSEM 5100	INA 95 to 1301
44 45 46 47	Height Weight Military specifications conformance Power requirements Voltage (ac) Current	32" (on pedestal) 61 lbs. INA 117V ±10% 3 Amp. surge; 2 Amp. erg.	80 lbs. INA 120V INA	290 lbs. INA 115V INA	83 lbs INA 117V 10% INA	INA INA 120V Std, 240V optional INA	MIL-STD-188C NACSEM 5100 115V : 10% 3.15 Amp	95 to 130'
44 45 46 47 48	Height Weight Military specifications conformance Power requirements Voltage (sc) Current Frequency	32" (on pedestel) 61 lbs. INA 117V ±18% 3 Amp. surge; 2 Amp. avg. 60 Hertz	80 lbs. INA 120V INA 60 Hertz	290 lbs. INA 115V INA 60 Hertz	83 lbs INA 117V 10% INA 60 Hertz	INA INA 120V Std, 240V optional INA 60 Hertz std; 50 Hertz aptianal	MIL-STD-188C NACSEM 5100 115V : 10% 3.15 Amp 48-52 or 58-62 Hertz	95 to 1301 INA INA
44 45 46 47	Height Weight Military specifications conformance Power requirements Voltage (ac) Current	32" (on pedestel) 61 lbs. INA 117V ±10% 3 Amp. surge; 2 Amp. avg. 60 Hertz	80 lbs. INA 120V INA 60 Hertz INA	290 lbs. INA 115V INA 60 Hertz Single	83 lbs INA 117V 10% INA 60 Hertz INA	INA INA 120V Std, 240V optional INA 60 Mertz std; 50 Mertz optional INA	MIL-STD-188C NACSEM 5100 115V : 10% 3.15 Amp 48-52 or 58-62 Hertz Single	95 to 130'
44 45 46 47 48 40	Height Weight Military specifications conformance Power requirements Voltage (sc) Current Frequency Phones Watts	32" (on pedestel) 61 lbs. INA 117V ±18% 3 Amp. surge; 2 Amp. avg. 60 Hertz INA	80 lbs. INA 120V INA 60 Hertz	290 lbs. INA 115V INA 60 Hertz	83 lbs INA 117V 10% INA 60 Hertz INA INA	INA INA 120V Std, 240V optional INA 60 Hertz std; 50 Hertz aptianal	MIL-STD-188C NACSEM 5100 115V : 10% 3.15 Amp 48-52 or 58-62 Hertz Single 280	95 to 130' INA INA INA
44 45 46 47 48 40	Height Weight Military specifications conformance Power requirements Voltage (se) Current Frequency Phones	32" (on pedestel) 61 lbs. INA 117V ±10% 3 Amp. surge; 2 Amp. avg. 60 Hertz	80 lbs. INA 120V INA 60 Hertz INA	290 lbs. INA 115V INA 60 Hertz Single	83 lbs INA 117V 10% INA 60 Hertz INA	INA INA 120V Std, 240V optional INA 60 Mertz std; 50 Mertz optional INA	MIL-STD-188C NACSEM 5100 115V : 10% 3.15 Amp 48-52 or 58-62 Hertz Single	95 to 130' INA INA
44 45 46 47 48 48 50	Height Weight Military specifications conformance Power requirements Voltage (ac) Current Frequency Phones Wetts Status displays and indicators	32" (on pedestel) 61 lbs. INA 117V ±18% 3 Amp. surge; 2 Amp. avg. 60 Hertz INA	80 lbs. INA 120V INA 60 Hertz INA INA	290 lbs. INA 115V INA 60 Hertz Single 400 (max)	83 lbs INA 117V 10% INA 60 Hertz INA INA	INA INA 120V Std, 240V optional INA 60 Mertz std; 50 Mertz optional INA INA	MIL-STD-188C NACSEM 5100 115V : 10% 3.15 Amp 48-52 or 58-62 Hertz Single 280	95 to 130' INA INA INA 350
44 45 46 47 48 48 50	Height Weight Military specifications conformance Power requirements Voltage (ac) Current Frequency Phones Watts Status displays and indicators On/Off Standby Out of paper	32" (on pedestel) 61 lbs. INA 117V ±18% 3 Amp. surge; 2 Amp. avg. 60 Hertz INA	120V INA 120V INA 60 Hertz INA INA	290 lbs. INA 115V INA 60 Hertz Single 400 (max)	83 lbs INA 117V 10% INA 60 Hertz INA INA	INA INA 120V Std, 240V optional INA 60 Hertz std; 50 Hertz aptianal INA INA	MIL-STD-188C NACSEM 5100 115V : 10% 3.15 Amp 48-52 or 58-62 Hertz Single 280	95 to 130' INA INA INA 350
44 45 46 47 48 48 50 51 52 53	Height Weight Military specifications conformance Power requirements Voltage (ac) Current Frequency Phones Watts Status displays and indicators On/Off Standby Out of paper On-line/off-line	32" (on pedestel) 61 lbs. INA 117V ±18% 3 Amp. surge; 2 Amp. avg. 60 Hertz INA	80 lbs. INA I20V INA 60 Hertz INA INA INA INA INA INA	290 lbs. 1NA 115V INA 60 Hertz Single 400 (max) No No	83 lbs INA 117V 10% INA 60 Hertz INA INA	INA INA 120V Std, 240V optional INA 60 Hertz std; 50 Hertz aptional INA INA INA INA INA INA	MIL-STD-188C NACSEM 5100 115V : 10% 3.15 Amp 48-52 or 58-62 Hertz Single 280	95 to 130' INA INA INA 359 Yes INA INA
44 45 46 47 48 49 50 51 52 53	Height Weight Military specifications conformance Power requirements Voltage (ac) Current Frequency Phones Watts Status displays and indicators On/Off Standby Out of paper	32" (on pedestel) 61 lbs. INA 117V ±18% 3 Amp. surge; 2 Amp. avg. 60 Hertz INA	80 lbs. INA I20V INA 60 Hertz INA INA INA INA	290 lbs. INA I15V INA 60 Hertz Single 400 (mex) No	83 lbs INA 117V 10% INA 60 Hertz INA INA	INA INA 120V Std, 240V optional INA 60 Hertz std; 50 Hertz aptional INA INA INA INA	MIL-STD-188C NACSEM 5100 115V : 10% 3.15 Amp 48-52 or 58-62 Hertz Single 280	95 to 130' INA INA INA 358 Yes INA INA

		 		<u> </u>			
	02	03	04	05	06	07	08
	Data General Corp.	Data 100 Corp.	Racal-Milgo (ICC)	Perkin-Elmer Data Systems,	Teletype Corp.	Qume	Data Printer Corp.
		,		Terminal Division	1		Date :
tism)	6043	4430 Whisper Quiet	40 + 20C	Carousel 310	4010-8F0D	Sprint 5/45 RQ	1300
1131117					 		1260
	INA	INA	INA	INA	\$8205.	\$2140.	INA
	No	Yes	INA	Yes	Yes	Yes	INA
	5 x 7	INA	INA	No	No	No	No
	INA	Yes	INA	Yes	1		
					INA	INA	INA
	INA	Yes	INA	INA	INA	INA	INA
	INA	INA	INA	Yes	INA	Yeş	INA
	No	INA	No	10 or 12.5	No	10, 12 or 15	No
	INA	No	INA	Na	No	No	No
	No	No	INA	No	No	Yes	No
		INA	Yes	Yes	Yes	Yes	Yes
	INA	ļ.					į –
	30	(300 lines per minute)	(180 lines per minute)	40	3.7 lines/sec. (80 characters/line)	45 (55 optional)	600 line per minute (132 characters per line)
	' INA	INA	INA	INA	INA	Yes	INA
	. 6	6	6	6 or 8	6 or 3	6	6
	INA	INA	No	INA	INA	Yes	INA
	INA	INA	INA	INA	INA	INA	INA
	100				,		
	i						
	15"	16"	12-27/32"	15-1/2"	8-1/2"	14.65"	19.5"
	INA	No	Yes	Yes	Yes	Yes	INA
	INA	Yes	No	Optional	Optional	Yes	INA
	INA	INA	INA	INA	INA	5 inches/second	20" per second (40" per second optional)
	INA	INA	INA	INA	INA		'
				107		INA	INA
	INA	INA	INA		INA		INA
				INA		Yes	}
	ł			INA		Yes	
	1		}	1/100" increments		1/120"	
				1/48" increments		1/48"	
	:				1		
	İ		<u> </u>	INA		Yes	<u> </u>
	INA	Yes	Yes	Yes	Yes	INA	Yes
	 						
	i		l	١	1 100	. v-	
	Yes	INA	INA	Yes	INA	Yes	INA
	INA	INA	INA	INA	INA	INA	INA
	No	Yes	Yes	No	Yes	No	Yes
	Yes	No	No	Yes	No	Yes	Na
	40 characters	INA	120 characters	128 characters	2 tines (80 char./line)	224 characters	INA
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APPENDIX F
MEDIA SELECTION CRITERIA

APPENDIX F

MEDIA SELECTION CRITERIA

LIFE CYCLE COST

The life cycle cost includes all costs over the expected life of the equipment. The initial costs of equipment and programming, costs of spare parts, costs of repairs and maintenance on the equipment and personnel and training costs for operations and maintenance personnel, are the predominate cost elements. Costs for special support equipment for repair and maintenance would also be included, as well as the costs to utilize integrated logistics support concepts.

Cost consideration to be considered for all message entry devices includes:

- Current market price for small buys of equipment offered for military use
- Development costs of up-grading present equipment to military shipboard standards
- Development costs of new equipment designed for military shipboard standards
- Estimated cost of equipments procured in medium size buys after development is completed

PERFORMANCE

Smart Capabilities

Smart capabilities are the functions that can be performed by a terminal or unit in support of the message generation process. Typical smart functions of a terminal would be:

- Generation of pro forma message types for completion by "fill in the blanks"
- Editing of messages after entry
- Interaction of human and machine (e.g., prompting)
- Validation of input data
- Formatting of data and words according to predetermined formats

Versatility

Versatility is the ability to accept changes in existing functions. Some examples of versatility in a terminal would be its programmability to provide different functions, i.e., a half or full duplex capability or a capability to operate at various baud rates.

Expandability

Expandability is the capability to increase the number and type of functions, e.g., in a smart terminal, the size of memory, the instruction set of a processor or the number and type of I/O ports may be increased.

Throughput

Throughput for message entry devices (MEDs) is the number of messages of predetermined length that can be accepted by a device over a relatively long unit of time

(i.e., 720 messages of 1920 characters per hour). A minimum standard for throughput should be applied to all types of MEDs. In actual practice, however, the throughput of any automated message generation and preparation system will most likely be limited by the number of message drafters and message generation equipment operators.

Accuracy

Accuracy for MEDs is the error-free alphanumeric characters of symbols that are entered via the MED into the message preparation system. The character error rate indicates the quality of the MED. The quality of the MED is inversely proportional to the number of errors that occur undetected by the MED of the communication system, i.e., as quality goes up, the character errors go down. Also related to accuracy is the ability of the MED to recover as much usable data as possible from magnetic or paper media should they be accidentally damaged during handling.

Ease of Interface

The interface ease is the ease in making electrical or mechanical interfaces with existing equipments and new equipments yet to be introduced in message preparation systems. Using the same interface standards for present and future systems and equipment will ease interface problems. Handshaking signals and procedures as well as binary coded symbols will need to be standardized for present and future systems to ease interfacing problems.

Electrical Interfaces

Considered here are the electrical interfaces to the message preparation system. Examples are:

- RS-232C
- High level and low level TTY loops
- MIL-STD-188C
- NTDS slow
- NTDS fast
- ANEW

IMPACT ON SYSTEM (existing systems)

Administrative Control

This is the management of resources to achieve efficient message generation. Administrative control would need to be exercised only over a small area if there is one message entry point. Administrative control would be dispersed if there are many message entry points making control more complex and difficult.

Security measures and safeguards also would be confined to one area for a single point and dispersed for multiple message entry points. The safeguards would include TEMPEST qualified equipments and areas. Security measures would include operator

discipline and training and control of personnel access to message entry equipments and areas. More personnel and facilities are needed for many entry points than for one message entry point.

Processing Control

The processing control pertains only to message entry functions, equipment and procedures. The precedence of a message determines which message is processed first. Messages will be processed only if signed by a person with appropriate release authority. The higher the precedence, the less the writer-to-reader elapsed time in accordance with the requirement.

Replacement of Equipment

New equipment should reduce the number of existing equipments as well as personnel while providing faster message delivery. The amount of new equipment should be kept to a minimum.

Logistic Supportability

The logistic supportability is the ability of the supply system to furnish spare parts for repair and maintenance and the availability of test equipment and properly trained repair and maintenance personnel to keep the message generation system operating. Modularization of equipment using line replaceable items and modules can ease the logistic supportability problems. These problems will also be eased if new systems can be built that require simple or existing test equipment for repair and maintenance.

Commonality of message generation system equipment with other systems can reduce hardware and software development costs and help keep the logistics supportability requirements low. An example would be the use of standard peripherals and computers that will allow common hardware and software to be used in different systems.

Personnel

The number and skill level of operators required to operate message generation equipment would vary depending on the type of media and equipment. The average time spent by the operator for each message entered would indicate which media and equipment can reduce the personnel requirements.

MILITARY SPECIFICATION AVAILABILITY

The following military standards and specifications should be considered for application to message entry devices:

- MIL-STD-167, Mechanica: Vibrations of Shipboard Equipment. The Type I environment vibration would apply. An exploratory vibration test should be performed on each candidate for message entry device (MED).
- MIL-S-901, Shock Tests, H. I. (High Impact) Shipboard Machinery Equipment and Systems, Requirements for (NAVY). The MEDs would probably be of a

Grade B, Class II type. A Grade B type is "not required for the safety or continued combat capability of a ship." The "Class II equipment . . . will perform its specified functions, under the HI shock, with the use of resilient mounting which are allowed or required "

- MIL-E-16400, Electronic Equipment, Naval Ship and Shore, General specification
- MIL-STD-810, Environmental Test Methods
- MIL-STD-1397, Input/Output Interfaces, Standard Digital Data, Navy Systems
- MIL-STD-1472, Human Engineering Design Criteria for Military Systems Equipment and Facilities
- MIL-STD-1671, Mechanical Vibrations of Shipboard Equipment (Type I Environmental and Type II Internally Excited)
- MIL-STD-188, Military Communication System Technical Standards
- MIL-STD-454, Standard General Requirements for Electronic Equipment
- MIL-STD-461, Electromagnetic Interference Characteristics, Requirements for Equipment
- MIL-STD-46855, Human Engineering Requirements for Military Systems, Equipment and Facilities
- NACSEM 5100 (CONFIDENTIAL), Compromising Emanations Laboratory Test Standard Electromagnetics

PHYSICAL CHARACTERISTICS

The primary physical characteristics for MEDs are size and weight. The maximum permissible volume and weight should be determined or design objectives established consistent with performance and capability. Needed are:

- Size and weight of available units
- Design objectives for development
- Estimates of size and weight for production models

POWER CONSUMPTION

The power consumption of present equipments should be noted and the power for developed equipments estimated. A reasonable standard consistent with performance would be helpful in the evaluation of candidate MEDs. A comparison of available MEDs within each type would show which unit uses the least power and has the lowest volt ampere requirements.

ATTACHMENT A

OPTICAL CHARACTER READER FOR THE AUTOMATED MESSAGE ENTRY SYSTEM

OPTICAL CHARACTER READER (OCR) FOR THE AUTOMATED MESSAGE ENTRY SYSTEM (AMES)

The AMES project at NOSC has resulted in an advanced development model of an automated message preparation system using an OCR for message entry. AMES is equivalent to a Level II system as described in this study report. AMES has been developed for the USMC for use in a tactical environment. The USMC has completed an OPEVAL OF AMES ADM and has entered into an acquisition program to procure 25 production versions with a First Article in January 1981. The Army has also opted to buy AMES in as yet an unspecified quantity. An AMES consists of optical character reader, system controller, magnetic tape cartridge unit, paper tape reader/punch, high speed printer and a keyboard video display terminal in an S-280 hut and is projected to cost \$210K per unit in production.

The OCR in the AMES ADM and AMES feasibility model has been a commercial version, Control Data Corporation 92650 (presently sold as a Scan Data Corporation 1150). During the course of system development and testing (three years), NOSC has logged a total of 5100 hours of usage on two machines. During this period the OCR(s) experienced eight failures. The details are presented in enclosure (1) to this Attachment A.

Exhibits 1 through 16 provide examples of messages accepted by the AMES. Particular attention is called to the fact that the AMES OCR does <u>not</u> require letter perfect copy and is, in fact, able to read misaligned characters, skewed lines, violated margins, stained and wrinkled copies, improper spacings, smudged characters, degraded print, etc. The AMES system also permits character, word and line delete as well as line(s) insert by the use of correction pages.

The input is prepared on red DD-173 forms with electric typewriters using an OCR A font, once only polyethylene ribbon and 10 character pitch. The output for the exhibits was taken from the line printer after the system has assigned RIs and reformatted the message to the operator selected ACP 126 Mod, ACP 127 or JANAP 128 format.

Table AA1 provides technical specifications on the CDC92650.

ATTACHMENT A

Table AA1. CDC 92650 - Technical specifications.

Character recognition rate	684 characters/second
Page throughput	5 pages/minute
Maximum character substitution rate (ANSI print quality range X) ⁽¹⁾	1/100,000
Maximum character reject rate (ANSI print quality range X)(1)	1/10.000
Maximum character substitution rate (ANSI print quality range Y) ⁽¹⁾	1/50,000
Maximum character reject rate (ANSI print quality range Y(1)	1/5,000
Maximum line skew permitted ⁽²⁾	±0.13 inches
Maximum character skew permitted ⁽²⁾	±2° Angular rotation
Maximum character misalignment permitted (2)	±1/2 Character height vertically
Minimum adjacent character separation permitted (2)	0.014 inches
Minimum print contrast signal permitted (2)	50%

NOTES:

- 1. Typical reading accuracy is an order of magnitude higher than those specified.
- 2. Reading tolerance is based on character spacing of 10 characters/inch and line spacing of 3 lines/inch.

AMES OCR RELIABILITY DATA

During development, test and evaluation of the AMES feasibility model and the AMES advanced development model, NOSC obtained the following rehability data on the Control Data Corporation 92650 terminal optical character reader (TOCR).

- I. AMES feasibility model (TOCR S/N 1 was used; this unit is a preproduction model)
 - A. Two months at NOSC (9/75-10/75)
 - 1. Approximate number of operating hours was 480
 - One failure occurred
 - a. Bad comparator PC card
 - b. Corrective maintenance performed by NOSC engineer
 - B. Three months at First Marine Division, Camp Pendleton, CA (11/75-1/76) for operational testing; in a garrison environment
 - 1. Approximate number of operating hours was 600
 - 2. No failures occurred
 - C. Two months at NOSC (7/77-8/77)
 - 1. Approximate number of operating hours was 100
 - 2. One failure occurred
 - a. Bad comparator PC card (received from contractor with defect)
 - b. Corrective maintenance performed by NOSC engineer
 - D. One month in Germany for REFORGER 77 (9/77); in a garrison environment
 - 1. Approximate number of operating hours was 340
 - 2. No failures occurred; however, the CDC engineering supporting the TOCR made four circuit modifications
 - a. Two modifications were required to compensate for heat sensitive components; these heat problems have been corrected in the production models of the TOCR
 - b. The other two modifications should have been made six months earlier, but factory technicians failed to do so
- II. AMES advanced development model (TOCR S/N 146 was used)
 - A. Twelve months at NOSC (4/77-3/78)
 - 1. Approximate number of operating hours was 2080
 - 2. Four failures occurred:
 - a. Bad display generator PC card; corrective maintenance done by CDC technician (received from contractor with defect)

Enclosure 1 to Attachment A

- b. Bad power supply TRIAC; corrective maintenance done by NOSC engineer
- c. Bad solid state array used in the optics; corrective maintenance done by CDC engineer
- d. Bad encoder PC card; corrective maintenance done by NOSC engineer
- B. One month at First Marine Division, Camp Pendleton, CA (4/78) for operational testing; in a garrison environment
 - 1. Approximate number of operating hours was 420
 - 2. One failure occurred:
 - a. Bad eject stacker motor control PC card
 - b. Corrective maintenance done by NOSC engineer
- C. Three weeks at Camp Pendleton, CA (5/78) for transportability testing; tactical environment; NOSC installed shock mounts on the TOCR and added mechanical stiffeners such as card retainers, cable connector retainers and panel latches
 - 1. Approximate number of operating hours was 100
 - 2. No failures occurred

NOTE: Not included in the above information are the following two problems which were investigated by the CDC engineer

- 1. Timing problem (actually a design error) on the format controller PC card; a circuit modification was made by the CDC engineer as a temporary solution to the problem
- 2. Fault detect logic card falsely indicated an error in the optic alignment; the CDC engineer determined the optics were in perfect alignment, but could not solve the problem; this does not in anyway affect the TOCR's reading abilities
- D. Three months (6/78-8/78) at various locations (NOSC, East Coast, Germany) for the purpose of demonstrations (AFCEA, USAREUR)
 - 1. Approximate number of operating hours was 480
 - 2. No failures occurred
- E. One month in Germany for REFORGER 78 (9/78); in a garrison environment
 - 1. Approximate number of operating hours was 340
 - One failure occurred
 - a. Bad fault detect logic PC card
 - b. Corrective maintenance performed by CDC technician

Enclosure 1 to Attachment A

- F. Two months (10/78-11/78) on East Coast for demonstrations at various locations
 - 1. Approximate number of operating hours was 160
 - 2. No failures occurred

Approximate total operating hours as of 12/18/78 is 5,100.

Total number of failures as of 12/18/78 was eight.

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FM CG MCDEC QUANTICO VA
TO CG FIRST MARDIV
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THE TYPIST ALSO HAS THE CAPABILITY TO DELETE AN ENTIRE LINE BY USING
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THE DD-173 HEADER LINE CONTAINS AN INVALID ACTION PRECEDENCE.
MEADER ERRORS ARE CORRECTED BY THE OPERATOR VIA THE KEYBOARD
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Exhibit 13

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P 8917362 JUN 78
FW CG FIRST MARDIV
TO RUMDXAA/CMIO SAN DIEGO CA
INFO RUEACMC/CMC MASHINGTON DC
RUEAJMA/CG MCDEC QUANTICO VA
3T
C O N F I D E N T I A L //N12343//
NO CLASSIFIED INFORMATION IS CONTAINED IN THIS TEST MESSAGE.
THIS MESSAGE HAS A SECURITY MISMATCH, THE TEXT CLASSIFICATION DOES
NOT AGREE MITH THE DD-173 HEADER LINE, SO THE MESSAGE WILL BE
AUTOMATICALLY ABORTED.
3T
#4522

NNN's

Exhibit 14

-	JOINT MESSAGEFORM
P.A	TOURISH ON MILE LAND CHE TOURS OF A TO FORME ISAUE CENTER ON MAIN ATTICL STITE OF THE MERCHANIC CENTER OF THE TOURS OF THE TOURISH OF THE TOU
נס', ננ	1601055 PP RR - AT - BUUU ZYUW
	
	FROM NAVOCEANSYSCEN SAN DIEGO CA
	TO CG FIRST MARDIV
	CG MCB CAMP PENDLETON CA
	INFO CMC WASHINGTON D.C.
	ZEN/CG MCDEC QUANTICO VA
	AFCEA WASHINGTON DC
	MARBKS WASHINGTON DC
	DA WASHINGTON DC
INCLAS	//NES113//
F A PL	A IS NOT CONTAINED IN THE PLA/RI FILE, THE OPERATOR IS ASKED
o Zupe	PLY A ROUTING INDICATOR AND ASSOCIATED CLASSIFICATION
CHARACT	ER, USE THE INTERCEPT RI, OR INDICATE ZEN FOR THAT PLA.
g to to to	
DIS TH	
Do, 18	
Dis. 14	
	THED NAME TITLE OFFICE STMBUL PHONE & DATE SPECIAL INSTRUCTIONS
ÇHALTI H. S	
ÇHALTI H. S	NAME THE OFFICE SYMBOL AND PHONE

132

;

PATUZYUN RUNJDFN2974 1642848-UUUU--RUAFCEA RUEACMC RUNJDFC,
ZNR UUUUU
PR 132849Z JUN 78
FM NAVOCEANSYSCEN SAN DIEGO CA
TO RUNJDFN/CG FIRS MARDIV
RUNJDFN/CG MCB CAMP PENDLETUN CA
INFO RUEACMC/CMC MASHINGTON D.C.
ZEN/CG MCDEC GUANTICO VA
RUAFCEA/AFCEA MASHINGTON DC
ZEN/MAHBKS MASHINGTON DC
RUNJDFC/DA MASHINGTON DC
BT
UNCLAS//N22113//
IF A PLA IS NOT CONTAINED IN THE PLA/RI FILE, THE OPERATOR IS ASKED
TO SUPPLY A ROUTING INDICATOR AND ASSOCIATED CLASSIFICATION
CHARACTER, USE THE INTERCEPT RI, OR INDICATE ZEN FOR THAT PLA.
BT
#8334

NNNN

Exhibit 15

	SECURITY CLASSIFICATION
JOINT MESSAGEFORM	
PAGE DESCRIPTION PROCEDURES LMF CLASS CIC	FOR MESSAGE CENTER/COMMUNICATIONS CENTER ONLY
DI OF OL 1601011 PP RR AT WWW ZYW	ILL SOLING INSTRUCTIONS
PROM: NAVOCEANSYSCEN	SAN DIEGO CA
TO: CG FIRST MARDI	V
INFO CMC WASHINGTON	• DC
CG MCDEC QUANT	ICO, VA
CG MCB CAMP PE	NDLETON CA
NCC 42 \\ND5000\\	
MES IS CAPABLE OF FALLBACK TO A D	EGRADED MODE OF OPERATION USING AN
LTERNATE MESSAGE ENTERY CAPABILIT	Y IN THE EVENT OF FAILURE TO THE
CR SCANNING UNIT- IF ONLY THE SCA	NNING UNIT BECOMES INOPERATIVE.
HE SYSTEM FIRMWARE IS CAPABLE OF	ACCEPTING DD-173 FORMAT MESSAGES
ROM THE KDT AND PERFORMING THE PR	OCESSING AND PREPARATION FUNCTIONS
OV TRANSMISSION VIA AUTODIN AND/O	R PAPER TAPE. AMES RETAINS THE
T OT ZEBAZZEM TURTUO OT YTIHBARA	HE AN/TYC-5A AIU OR TO THE PTP
HOULD FAILURE OCCUR TO THE CMTU A	ND/OR LP.
INNN	
DISTR	
DESCRIPTION NAME AND CONTRACT PARTY PARTY	ISPECIAL INSTRUCTIONS
DRAFTER TYPED NAME TITLE OFFICE SYMBOL, PHONE & DATE	arecial instructions
TYPED NAME TITLE OFFICE SYMBOL AND PHONE	
	1
SIGNATURE	SECURITY CLASSIFICATION DATE TIME GROUP

PATUZYUW RUWJDFN0002 1640846-UUUU-RUEACMC RUEBJMA RUWJDFC.
ZNR UUUUU
P R 130847Z JUN 78
FM NAVOCEANSYSCEN SAN DIEGO CA
10 RUWJDFN/CG FIRST MARDIV
INFO RUEACMC/CMC WASHINGTON, DC
RUEBJMA/CG MCDEC QUANTICO, VA
RUWJDFC/CG MCB CAMP PENDLETON CA
81
UNCLAS //N02000//
AMES IS CAPABLE OF FALLBACK TO A DEGRADED MODE OF OPERATION USING AN
ALTERNATE MESSAGE ENTHY CAPABILITY IN THE EVENT OF FAILURE TO THE
DCR SCANNING UNIT. IF DNLY THE SCANNING UNIT BECOMES INOPERATIVE,
THE SYSTEM FIRMMARE IS CAPABLE OF ACCEPTING DD-173 FORMAT MESSAGES
FROM THE KDT AND PERFORMING THE PROCESSING AND PREPARATION FUNCTIONS
FOR TRANSMISSION VIA AUTODIN AND/OR PAPER TAPE. AMES RETAINS THE
CAPABILITY TO OUTPUT MESSAGES TO THE AN/TYC-5A AIU OR TO THE PTP
SHOULD FAILURE OCCUR TO THE CMTU AND/OR LP.

NANN

Exhibit 16

ATTACHMENT B

ANNOTATED BRIEFING OUTLINE OF THE FINAL STUDY REPORT

ANNOTATED BRIEFING OUTLINE OF THE FINAL STUDY REPORT ON NAVAL OUTGOING MESSAGE PROCESSING

A STUDY OF MESSAGE GENERATION AND MESSAGE PREPARATION FOR TRANSMISSION AND THE IMPACT OF AUTOMATION

I. Study objectives

- A. Analyze the impact of automation on the naval outgoing message process
- B. Analyze the impact of media selection on message generation and preparation
- C. Develop conceptual message generation and preparation systems
 - 1. Various levels of automation
 - 2. Various choices of media
- D. Develop an equipment data base and project system costs

II. Study background

- A. In response to NSAP tasking (SURP-1-78)
- B. Outgrowth of previous NSAP tasking (TH-2-75)
 - 1. Automated message preparation feasibility study on USS OKLAHOMA CITY (May 76)
 - 2. Subsequent request to retain feasibility system by OKLAHOMA CITY (July 77)
 - 3. Additional request by USS KITTY HAWK to obtain automated message entry system (June 78)

III. Background

A. NOSC Code 8125 charter

- Plans, manages and executes system development projects from requirements, through design and development, to installation and support of Marine Corps and Special Systems
- 2. Translates mission requirements to system requirements; develops performance requirements; performs studies; allocates functions to hardware, software and procedure; synthesizes design solutions; conducts trade-off analyses; designs and tests systems; designs and develops associated hardware, software and firmware

B. NOSC Code 8125 related tasking

- 1. Development of OCA selection criteria and industry survey of OCRE (selection report Sept 74)
- 2. Development of AMES feasibility model and field evaluation for USMC (evaluation report May 76)
- 3. Development of shipboard AMP/OCR entry system and feasibility testing on USS OKLAHOMA CITY (test report Nov 76)
- 4. Assembly and field demonstration of an AMES feasibility model to USAREUR (Sept 77)
- 5. Development of AMES ADM for USMC (ADM & documentation Mar 78)
- 6. OPEVAL of AMES ADM by 1ST MARDIV (test report July 78)
- 7. Field testing of AMES ADM by USAREUR (Sept 78)
- 8. Development of AMES system (Type A) and OCR equipment (Type C2A) specifications (specifications Oct 78)
- 9. Study of automated message preparation systems and message entry devices for Navy shipboard application (study report Nov 78)

IV. Study approach

- A. Delineate the naval outgoing message process
- B. Define the message generation and preparation functions
- C. Analyze the functions in regard to automation
- D. Recommend candidates for automation
- E. Recommend message generation media
- F. Develop conceptual systems
- G. Project system costs

V. Automation goals

- A. Improve message throughput
- B. Decrease writer to reader time
- C. Reduce or eliminate message preparation errors
- D. Reduce personnel requirements
- E. Reduce skill levels

VI. Study definitions

- A. Message generation study
 - 1. Message composition station
 - 2. Message entry device
 - 3. Media
- B. Message preparation system
- C. Message transmission system

VII. Message generation functions

- A. Rough draft
- B. Draft
- C. Edit
- D. Chop
- E. Coordinate
- F. Final approval
- G. Release

VIII. Narrative message composition

- A. Consists of:
 - 1. Rough draft writing down thoughts/data in rough form
 - 2. Draft conversion of rough drafts to message generation process forms and formats
 - 3. Edit receipt and incorporation of proposed/directed changes and corrections
- B. Automation candidates basic
 - 1. Character erase/overwrite, delete, insert
 - 2. Line delete, insert
 - 3. Paragraph delete, insert
- C. Automation candidates -- advanced
 - 1. Message storage
 - 2. Word search
 - 3. Search and replace, delete

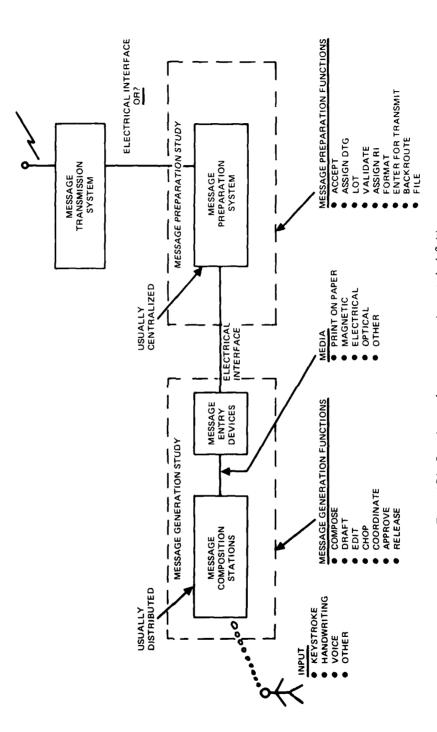


Figure AB1. Outgoing naval message processing - study definitions.

- 4. Word wrap, page wrap
- 5. Automatic paging
- 6. Interactive prompting
- 7. Input data validation

D. Equipment costs

- 1. Typewriter
 \$800/unit

 2. Smart typewriter (commercial grade)
 \$5K/unit

 3. Word processing system (commercial)
 \$15K/unit
- - a. KDT
 - b. Processor
 - c. Printer
 - d. Off-line storage

E. Conclusions

- 1. Basic automation aids are cost effective and desirable
- 2. A typewriter can provide the basic automation aids if correction pages are used; allows changes to message without message retype
- 3. Advanced automation aids are not cost effective when used for routine message traffic except in a fully automated ship
- 4. Advanced automation aids are cost effective when the time spent for message composition is significant and their distribution within the ship is limited to one or two locations

IX. Pro forma message composition

A. Consists of:

- 1. Insertion of data into blanks of rigidly specified message formats
- 2. Frequent and periodic transmission for data transfer to computer processing systems

B. Automation candidates

- 1. Interactive prompting
- 2. Input data validation
- 3. Canned message storage
- 4. Canned message maintenance
- 5. Message storage
- Writer need only specify the type of message and provide the data to be inserted

C. Equipment costs

- - a. KDT
 - b. Processor
 - c. Off-line storage
 - d. Printer

D. Conclusions

- 1. This is a prime area for automation
- 2. Cost effective only if centrally located and part of an automated message preparation system

X. Chop and coordinate

A. Consists of:

- 1. Review and approval by the chain of command
- 2. Disclosure of message to interested parties

B. Analysis

- 1. Involves mostly human functions
 - a. Reading
 - b. Making/suggesting changes
 - c. Routing
- 2. Requires hard copy for mark up
- 3. Not easily or effectively automated

XI. Approval and release

A. Consists of:

- 1. Formal authorized permission for message transmission by command
- 2. Transfer of message from the release authority to the communications center

B. Analysis

- 1. Involves mostly human functions
 - a. Reading
 - b. Making/suggesting changes
 - c. Indicating approval (signature or code)
 - d. Routing

- 2. Electrical routing to/from approval station may be cost effective
- 3. Not easily or effectively automated

XII. Media candidates

- A. Visual (typed or printed forms)
- B. Magnetic (cards, disks, tapes, etc.)
- C. Electrical (hard wired)

XIII. Media evaluation

A. Typewritten page

- 1. Human and machine readable (using an OCR)
- 2. Media cost is low (\$0.01 per page)
- 3. Equipment cost for one MCS is comparatively low (starts at \$800)
- 4. Requires comparatively little operator training time
- 5. Additional equipment is not required for chop, coordination or release stations
- 6. Present security procedures apply
- 7. Readers are available and suitable

B. Optical character readers (OCR)

- 1. Commercial OCRs cost about \$25K; MIL SPEC OCRs are not available
- 2. Size and weight are suitable for carry-on installation
- 3. State-of-the-art OCRs can tolerate (within reasonable limits)
 - a. Coffee stained, coke stained, wrinkled or dirty pages
 - b. Smudged or touching characters
 - c. Uneven character and line spacing
 - d. Uneven character print density
 - e. Variations in character stroke widths
 - f. Cloth ribbons
 - g. Type from manual OCR font typewriters
 - h. Skewed or misaligned characters or lines
 - i. Page misalignment within the typewriter
- 4. Data integrity of OCRs is several orders of magnitude higher than that afforded by the present manual preparation system
- 5. Page throughput is approximately 5/minute
- 6. OCRs have wide use and acceptance

C. Magnetic media

- 1. Require appropriate reading-display/print device at all "read" locations
- 2. Equipment costs per MCS start at \$7,000
- 3. MCS operator would require special training
- 4. Equipment costs for each message chop, coordination or release station are the same as those for one MCS
- 5. New security procedures are required
- 5. These media best suited for mass storage of messages

D. Electrical media

- 1. Require appropriate reading-display/print device at all "read" stations
- 2. Require installation of TEMPEST approved cables
- 3. Equipment cost for one MCS starts at \$5,000
- 4. Equipment costs for each message chop, coordination or release station are the same as those for one MCS
- 5. Special training is required for the MCS operator
- 6. Require security-approved equipment, spaces and safeguards for message protection

E. Media cost comparison

See Table AB1.

XIV. Media evaluation conclusions

- A. The visual (typed or printed page) media are the media of choice for all but the fully automated ship
- B. Magnetic media are good for mass message storage; not well suited to the processing of outgoing messages
- C. Electrical is the media of choice on the fully automated ship; electrical media cannot be justified on the basis of automated processing of outgoing message traffic only

XV. Media recommendations

- A. Retain type-on-paper as prime medium for all but the fully automated ship
- B. Consider electrical routing for high volume, high precedence message traffic between prespecified parties
- C. Use electrical media on the fully automated ship

Table AB1. Media cost comparison.

MEDIA	COST ESTIMATE PER UNIT	COST ESTIMATE PER 500 MESSAGES ⁽¹⁾			
Typewritten page	\$0.01/page	\$10			
Magnetic ⁽²⁾					
5-1/4 inch floppy disk	\$ 7.00/disk	\$ 1,750			
8 inch floppy disk	8.50/disk	2,125			
Hard disk	80.00/disk	20,000			
Tape cassette	7.00/cassette	1,750			
Tape mini-cartridge	18.00/cartridge	4,500			
Tape cartridge	19.00/cartridge	4,750			
Card	1.00/card	250			
Paper tape(3)	\$ 0.50/roll	\$ 6.25			
Electrical ⁽⁴⁾	Very low	Very low			

NOTES:

- 1. This represents roughly 10 days of message traffic based on USS OKLAHOMA CITY data.
- 2. Based on one message/unit, 50 messages/day, an average message length of 2100 characters, and the media, where applicable, is available for reuse once every 5 days; security problems associated with reusing the media are not considered.
- 3. Assumes an efficiency use of 40 messages/roll.
- 4. One time cable installation costs will be considerable.

XVI. Automation recommendations

- A. Retain the typewriter as the prime message composition station for all but the fully automated ship
- B. Provide a centralized pro forma message generation device
- C. Judiciously provide a few commercial grade smart typewriters at high volume, narrative message generation centers
- D. Use fully automated message composition stations on the fully automated ship

XVII. Message preparation functions

- A. Accept
- B. Prepare
- C. Transmit
- D. Backroute

- E. File
- F. Ancillary

XVIII. Message preparation functions analysis

- A. Message acceptance
 - 1. Paper is the most desirable medium
 - a. Message must be logged and verified
 - b. Message must be inspected
 - c. Special handling may be required
 - 2. Automation is not cost effective
 - a. Reader/display required
 - b. Mostly human involvement required
- B. Preparation for transmission
 - 1. Automation can greatly benefit this function
 - a. Improves accuracy
 - b. Reduces preparation time
 - c. Reduces personnel
 - 2. Candidates for automation
 - a. Assign and log unique DTG
 - b. Validate message parameters
 - c. Determine format and delivery circuit
 - d. Assign routing indicators
 - e. Prepare message in correct format and LMF
 - f. Place message in proper outgoing queue
- C. Message transmission
 - 1. Requires interconnect of an automated message preparation system to an automated communications center
 - 2. Requires development of software to control the interface properly
 - 3. Automation makes sense in conjunction with an automated communication system such as NAVMACS
- D. Message backrouting
 - 1. Cost effective candidates for automation
 - a. Determine recipients
 - b. Duplicate, collate and slot

- 2. Automation of the delivery function is cost effective only on the fully automated platform
 - a. Implies electrical routing
 - b. High cost for benefit
- 3. Should be integrated to a MRDIS or equivalent if available

E. Ancillary functions

- 1. File maintenance
 - a. Prime area for automation
 - b. Preferred medium is magnetic
- 2. Customer requests
 - a. Prime area for automation assistance
 - b. Access to data base is the primary task to be automated
- 3. Record keeping and report generation is prime area for automation/ automation assistance
- 4. File destruction
 - a. Highly dependent on file media
 - b. Not prime for automation

XIX. AMPS - Level I

A. Automated functions:

- 1. Input DD-173 (or equivalent) via:
 - a. Media reader
 - b. Paper tape reader (fallback mode)
 - c. Local and remote KDTs
- 2. Validate header and classification information
- 3. Assign DTG, SSN and/or TOF (automatically or manually)
- 4. Convert message into either plaindress or abbreviated plaindress for ACP 126 modified
- 5. Semi-automatically section the message
- 6. Output formatted message:
 - a. Electrically over a cable to NAVMACS
 - b. To PTP in either ITA#2 or ASCII
- 7. Provide proof of transmission copy and/or journal log
- 8. Compile message statistics
- 9. Permit editing of the message through use of correction pages
- 10. Provide query/response interaction with the operator
 - a. System control
 - b. System parameter selection
 - c. Header field editing/correction
- 11. Provide on-line and off-line system self-test features

B. System Costs

EQUIPMENT TYPE, NOMENCLATURE	MAGNETIC MEDIA		VISUAL MEDIA		ELECTRICAL MEDIA	
AND UNIT COST	QTY	COST	QTY	COST	QTY	COST
CPU, \$30K	1	S 30K	1	\$ 30K		
CPU, AN/AYK-14(V)						
CPU, AN/UYK-7, \$550K						
CPU, AN/UYK-7, \$865K						
KDT, AN/USQ-69, \$16K	2	32K	2	32K		
PTR/P, RD-397/U, \$17K	1	17K	1	17K		
LP, TT-624(V)/UG, \$23K	1	23K	1	23K		
CMTU, AN/USH-26(V). \$23K						
MTU, RD-358, \$125K						
MDU, RD-281/UYK, \$400K						
PCR, \$20K		1				
OCR, \$50K			1	50K		
MMMVT, \$66K	1	66K				
EMMVT, AN/USQ-69, \$16K						
MMMCT, \$89K	2	178K				
VMMCT, SELECTRIC II, \$1K		1	4	4K		
AN/USQ-69, EMMCT. TT-624(V)/UG, \$39K						
MMR, \$20K	ı	20K				
MRDIS, \$125K						
COST SUMMARIES						
BASIC SYSTEM HARDWARE		366K		156K		
SOFTWARE DEVELOPMENT AND DOCUMENTATION		200K		200K		
SYSTEM DESIGN		*		*		
SYSTEM ASSEMBLY		*		*		
SYSTEM INTEGRATION AND TESTING		*		*		
SYSTEM DOCUMENTATION		*		*		
SYSTEM INSTALLATION		*		*		
LIFE CYCLE SUPPORT		*		*		
HARDWARE AND SOFTWARE COSTS		566K		356K		

^{*}Unknown

C. Conclusions

- 1. Low cost, low risk
- 2. Automates the processing of 80-90% of typical outgoing message traffic
- 3. Suitable for small ships
- 4. Significant enhancement even to large ships

XX. AMPS - Level II

A. Automated functions:

- 1. Includes all of the capabilities of AMPS I
- 2. Validate addressee and verify classification information
- 3. Assign an RI to each PLA according to:
 - a. Message security classification
 - b. Output format
- 4. Assign the required RIs to each AIG
- 5. Permit message handling instructions to be added to format header lines
- 6. Convert message into either plaindress or abbreviated plaindress for:
 - a. JANAP 128
 - b. ACP 127
 - c. ACP 126
- 7. Create separate history and journal file for all messages transferred to NAVMACS and/or the PTP
- 8. Provide non volatile file storage for a minimum of:
 - a. 200 PLAs and corresponding RIs
 - b. 5 AIGs and associated RIs
- 9. Provide off-line message retrieval from history file
 - a. Retrieval parameters are DTG, SSN, and/or TOF
 - b. Output retrieved message to the LP and/or PTP
- 10. Provide off-line retrieval from the journal file to obtain a hardcopy printout of an entire day's log

B. System Costs

EQUIPMENT TYPE, NOMENCLATURE	MAGNETIC MEDIA		VISUAL MEDIA		ELECTRICAL MEDIA	
AND UNIT COST	QTY	COST	QTY	COST	QTY	COST
CPU, \$30K						
CPU, AN/AYK-14(V)	1	S 60K	i	S 60K		
CPU, AN/UYK-7, \$550K						
CPU, AN/UYK-7, \$865K						
KDT, AN/USQ-69, \$16K	2	32K	2	32K		
PTR/P. RD-397/U, \$17K	1	17K	1	17K		
LP, TT-624(V)/UG, \$23K	1	23K	1	23K		
CMTU, AN/USH-26(V), \$23K	1	23K	j	23K		
MTU, RD-358, \$125K						
MDU, RD-281/UYK, \$400K						
PCR, \$20K						
OCR, \$50K			1	50K		
MMMVT, S66K	1	66K				
EMMVT, AN/USQ-69, \$16K						
MMMCT, \$89K	3	267K				
VMMCT, SELECTRIC II, \$1K			6	6 K		
AN/USQ-69, EMMCT, TT-624(V)/UG, \$39K						
MMR, \$20K	l	20K				
MRDIS, \$125K						
COST SUMMARIES						
BASIC SYSTEM HARDWARE		508K		211K		
SOFTWARE DEVELOPMENT AND DOCUMENTATION		400K		400K		
SYSTEM DESIGN		*		*		
SYSTEM ASSEMBLY		*		*		
SYSTEM INTEGRATION AND TESTING		*		*		
SYSTEM DOCUMENTATION		*		*		
SYSTEM INSTALLATION		*		*		
LIFE CYCLE SUPPORT		*		*		
HARDWARE AND SOFTWARE COSTS		908K		611K		

^{*}Unknown

C. Conclusions

- 1. Moderate cost, low risk
- 2. Automates the processing of 90% of typical outgoing message traffic
- 3. Suitable for medium to large ships
- 4. Most cost effective system

XXI. AMPS Level III

A. Automated functions:

- 1. Includes all the capabilities of AMPS I and II
- 2. Input DD-173 (or equivalent) formatted messages via:
 - a. Punched card reader or magnetic media reader (remote or local)
 - b. Additional local KDT
- 3. Assign an RI to each PLA according to the:
 - a. LMF of the message
 - b. Delivery circuit required for transmission
- 4. Add message handling instructions to the format header lines based on routing information contained in the PLA/RI file
- 5. Segment the message
- 6. Section the message
- 7. Convert input message into JANAP 128 or ACP 126 modified data pattern upon request
- 8. Determine format and delivery circuit and place formatted message in proper outgoing queue by precedence
- 9. Retrieve message from outgoing queue (FIFO by precedence) and transmit over the proper delivery circuit
- Obtain acknowledgement for the message and log transmission or cancellation time
- 11. Retrieve messages from the history file based on any one or any combination of DTG, SSN, TOF and originator's PLA
- 12. Provide capability to modify and automatically retransmit a message contained in the history file
- 13. Provide capability to automatically readdress a message contained in the history file
- 14. Compile detailed message statistics for the purpose of automatically generating on-ship and off-ship communications reports or messages
- 15. Generate pro forma messages
 - a. Accept and insert input data
 - b. Storage of 50 canned message formats
- 16. Determine recipients of backrouted message
- 17. Prepare copies of message to be backrouted
 - a. Duplicate
 - b. Collate
 - c. Slot

B. System Costs

EOUIPMENT TYPE, NOMENCLATURE		NETIC EDIA	VISUAL MEDIA		FLECTRICAL MEDIA	
AND UNIT COST	QTY	COST	QTY	COST	QTY	COST
CPU, \$30K						
CPU, AN/AYK-14(V)						
CPU, AN/UYK-7, \$550K	1	S 550K	1	\$ 550K		
CPU, AN/UYK-7, \$865K						
KDT, AN/USQ-69, \$16K	3	48K	3	48K		
PTR/P, RD-397/U, \$17K	1	17K	ı	17K		
LP, TT-624(V)/UG, \$23K	ì	23K	l	23K		1
CMTU. AN/USH-26(V), \$23K						1
MTU, RD-358, \$125K	1	125K	1	125K		
MDU, RD-281/UYK, \$400K	1	400K	I	400K		
PCR, S20K	l	20K	1	20K		
OCR, \$50K			1	50K		
MMMVT, \$66K	2	132K				
EMMVT, AN/USQ-69, \$16K						
MMMCT, \$89K	6	534K				
VMMCT. SELECTRIC II, S1K			12	12K		
AN/USQ-69, EMMCT, TT-624(V)/UG, \$39K		1				
MMR, \$20K	2	40K	1	20K		
MRDIS, \$125K	1	125K		125K		
COST SUMMARIES		1			=	
BASIC SYSTEM HARDWARE		2014K		1390K		1
SOFTWARE DEVELOPMENT						
AND DOCUMENTATION		1500K	<u> </u>	1500K		
SYSTEM DESIGN		*		*		
SYSTEM ASSEMBLY		*		*		ļ
SYSTEM INTEGRATION AND TESTING		*		*		
SYSTEM DOCUMENTATION		*		*		
SYSTEM INSTALLATION				L		ļ
LIFE CYCLE SUPPORT	<u> </u>	*		*		
HARDWARE AND SOFTWARE COSTS		3514K		1890K		

^{*}Unknown

C. Conclusions

- 1. High cost, low to moderate risk
- 2. Automates the processing of essentially all outgoing message traffic
- 3. Suitable for large ships
- 4. Provides only a small increase in capability over AMPS II at considerable increase in cost

XXII. AMPS - LEVEL IV

- A. Automated functions:
 - 1. Includes all of the capabilities of AMPS I, AMPS II and AMPS III
 - 2. Input DD-173 (or equivalent) formatted messages via:
 - a. Two local KDTs
 - b. Eight (maximum) remote KDTs
 - 3. Remote KDTs also capable of:
 - a. Message generation functions
 - b. Customer request
 - 4. Automate the acceptance function
 - a. Observe message precedence and handle accordingly
 - b. Ensure message has been properly staffed
 - c. Check for a valid release authority
 - d. Log receipt time
 - 5. Distribute/deliver backrouted message copies and requested message file copies to the proper remote LP (up to 13 LPs)
 - 6. Provide security safeguards to ensure that remote KTDs and LPs, as well as their operators are cleared to handle classified messages

B. System Costs

EQUIPMENT TYPE, NOMENCLATURE	MAGNETIC MEDIA		VISUAL MEDIA		FLECTRICAL MEDIA	
AND UNIT COST	QTY	COST	QTY	COST	QTY	COST
CPU, \$30K						
CPU,AN/AYK-14(V)					_	
CPU, AN/UYK-7, \$550K						
CPU, AN/UYK-7, \$865K					1	S 865K
KDT. AN/USQ-69, \$16K					3	48K
PTR/P, RD-397/U, \$17K					1	17K
LP, TT-624(V)/UG, \$23K					6	138K
CMTU, AN/USH-26(V), \$23K						
MTU, RD-358, \$125K					1	125K
MDU, RD-281/UYK, \$400K					1	400K
PCR, \$20K					1	20K
OCR, \$50K						
MMMVT, \$66K						
EMMVT, AN/USQ-69, \$16K					2	32K
MMMCT, \$89K						
VMMCT, SELECTRIC II, \$1K						
AN/USQ-69, EMMCT, TT-624(V)/UG, \$39K					8	312K
MMR, \$20K					1	20K
MRDIS, \$125K						
COST SUMMARIES						
BASIC SYSTEM HARDWARE		41				1977K
SOFTWARE DEVELOPMENT AND DOCUMENTATION					- X	3000K
SYSTEM DESIGN						*
SYSTEM ASSEMBLY						*
SYSTEM INTEGRATION AND TESTING						*
SYSTEM DOCUMENTATION						*
SYSTEM INSTALLATION						*
LIFE CYCLE SUPPORT						*
HARDWARE AND SOFTWARE COSTS						4977K

*Unknown

C. Conclusions

- 1. Very high cost, moderate risk
- 2. Automates all message preparation functions
- 3. Practical only on fully automated ships

XXIII. Summary

- A. The visual media are familiar and comfortable; present procedures security and otherwise apply; damaged media data recovery is high; readers are available and suitable; well suited to the outgoing message process
- B. Magnetic media are well suited to mass message storage; not well suited to the message generation or preparation process
- C. Electrical media are cost effective only on the fully automated ship
- D. Message generation functions, with the exception of composition aids, tend not to be candidates for automation
- E. Message preparation functions, in general, tend to be high payoff candidates for automation

XXIV. Recommendations

- A. Automate all message generation and preparation functions and use electrical media only on the fully automated ship
- B. Otherwise
 - 1. Use type or print on paper as the prime message medium
 - 2. Retain the typewriter as the prime message composition station
 - 3. Provide a few judiciously located smart typewriters for high volume stations
 - 4. Provide electrical routing between a few prespecified stations for high volume, high precedence traffic
 - 5. Provide all but the fully automated ship with an AMPS Level II system upgraded or downgraded as appropriate

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